THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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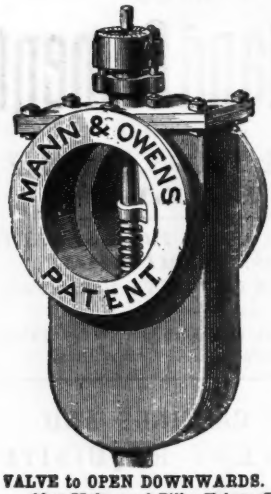

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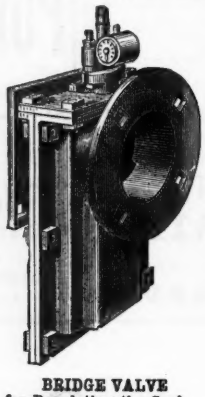

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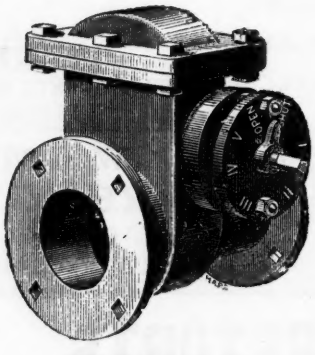

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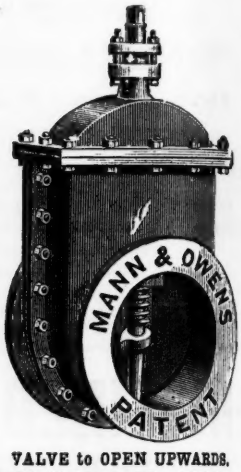

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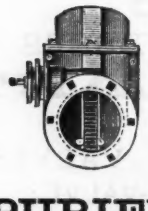

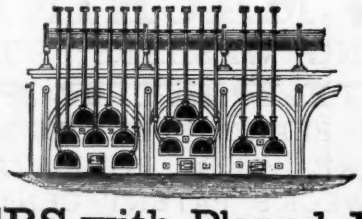

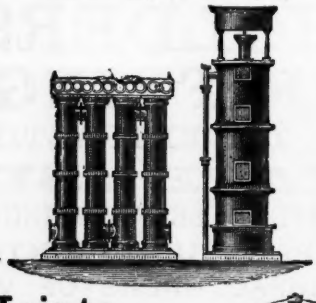

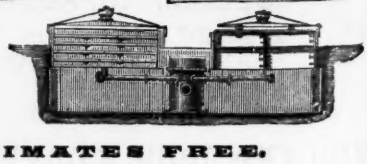

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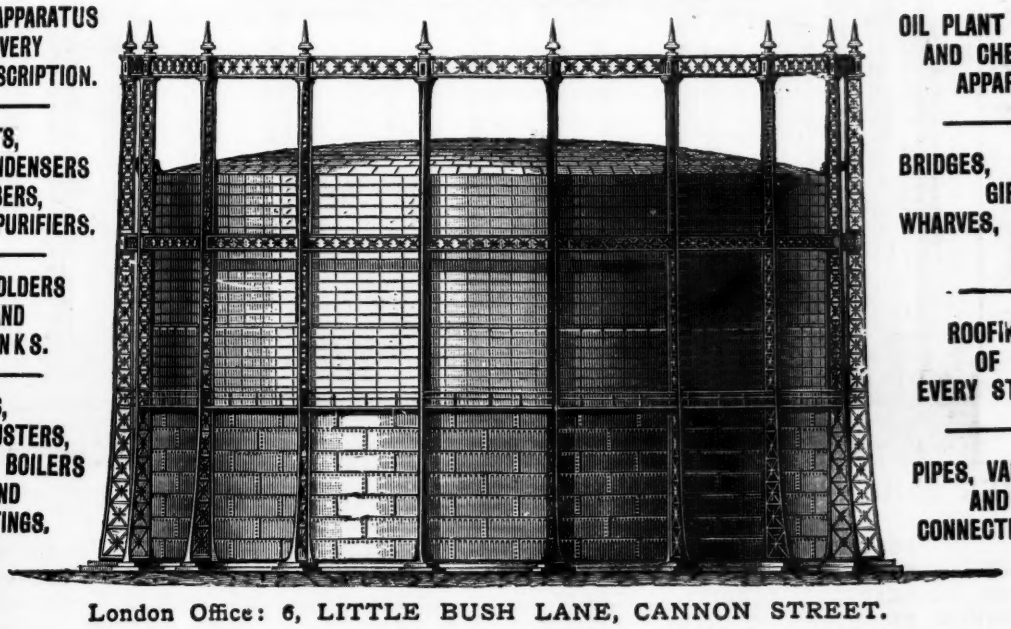

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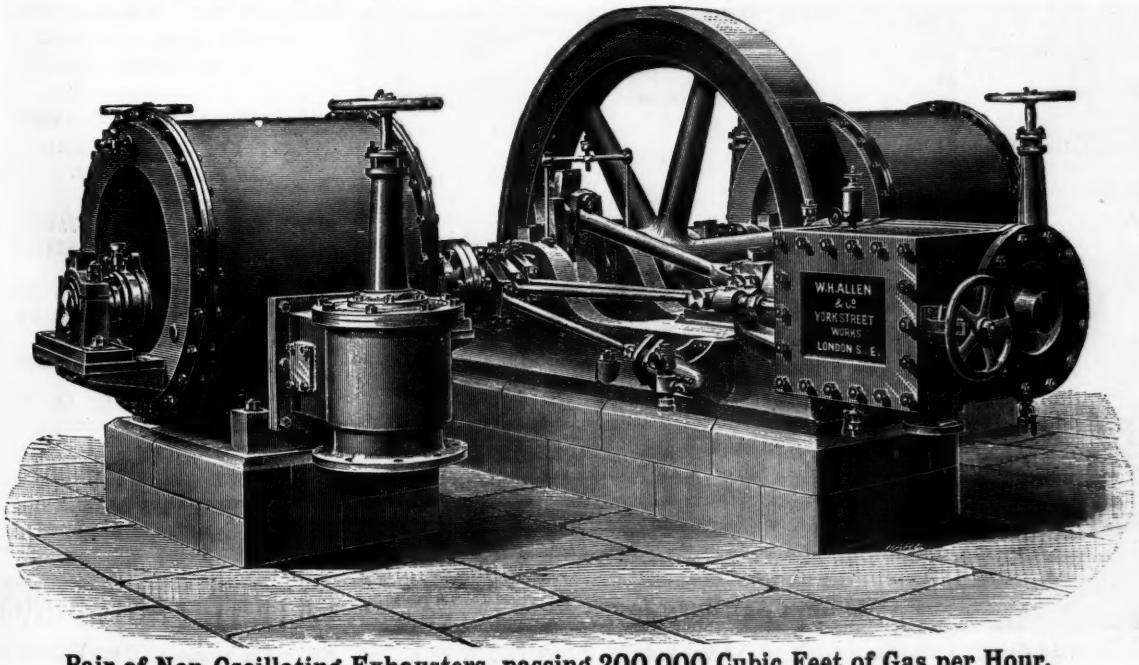

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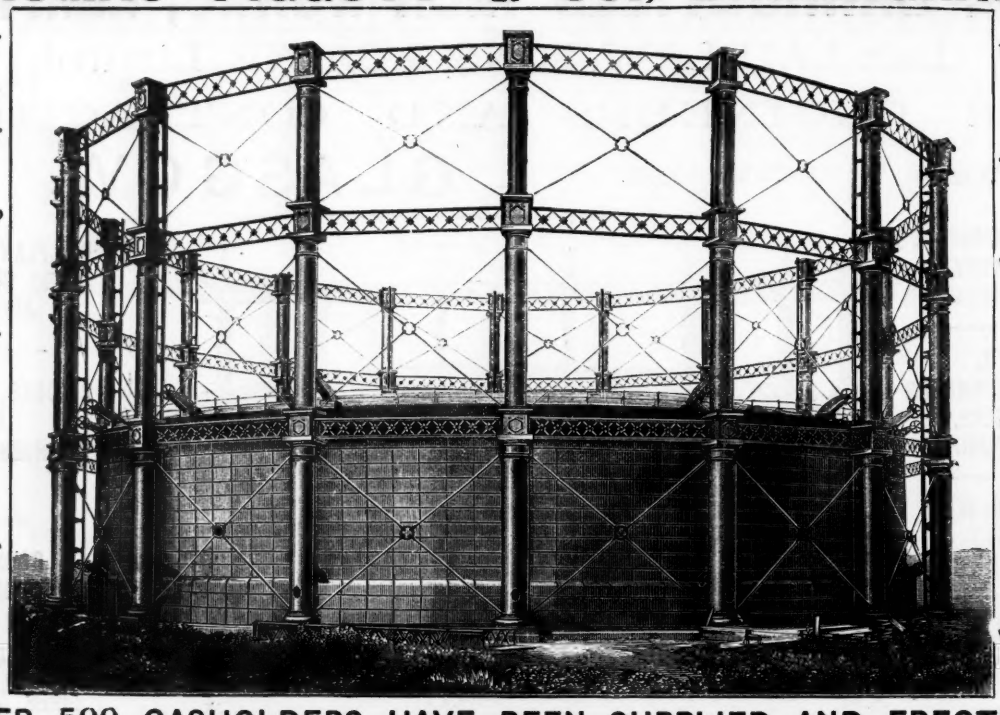

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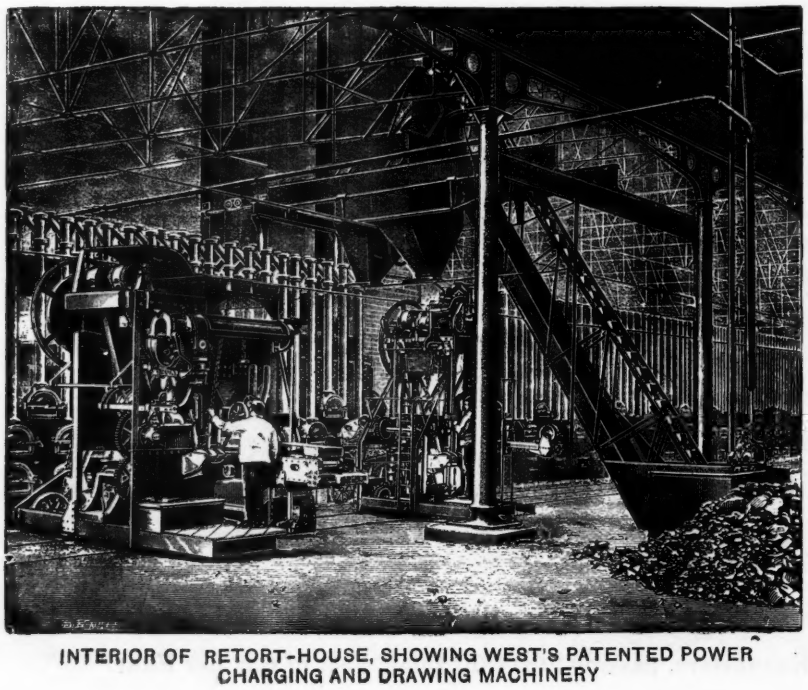

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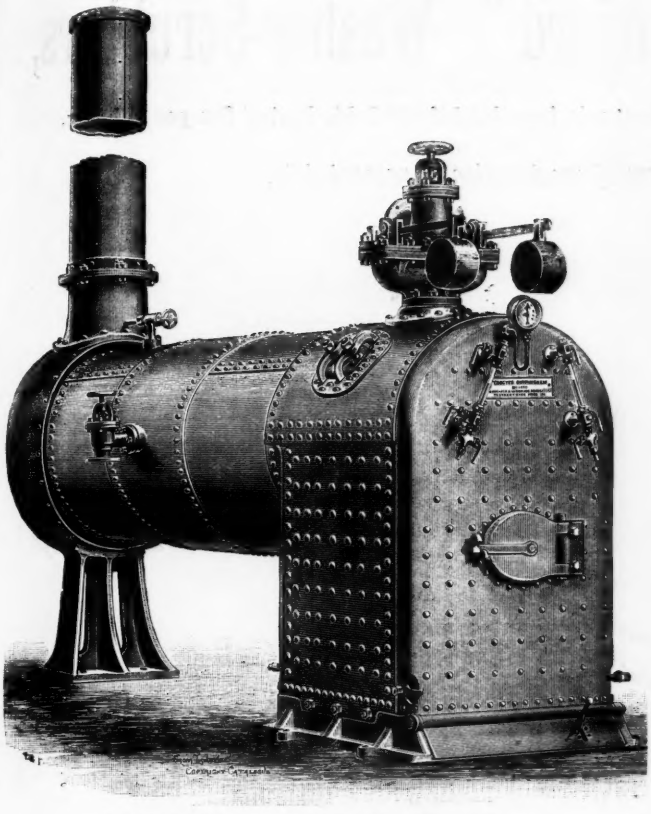

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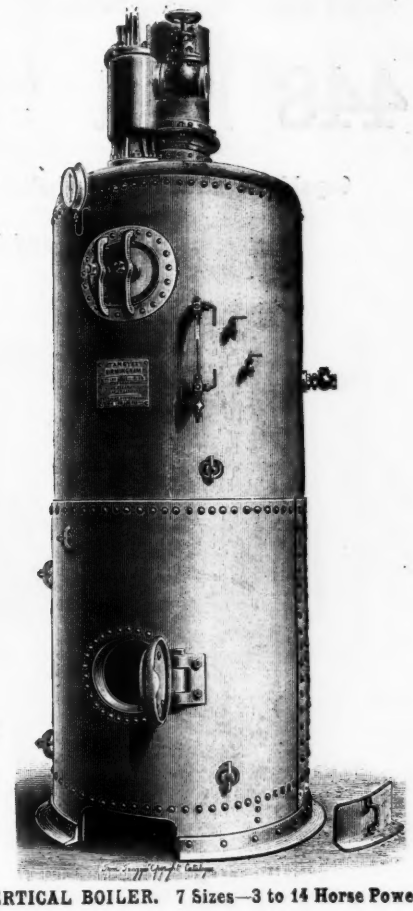

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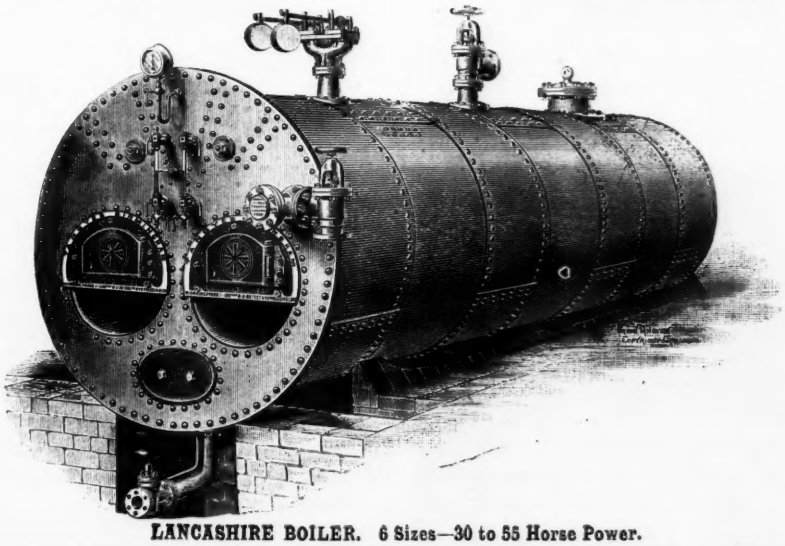

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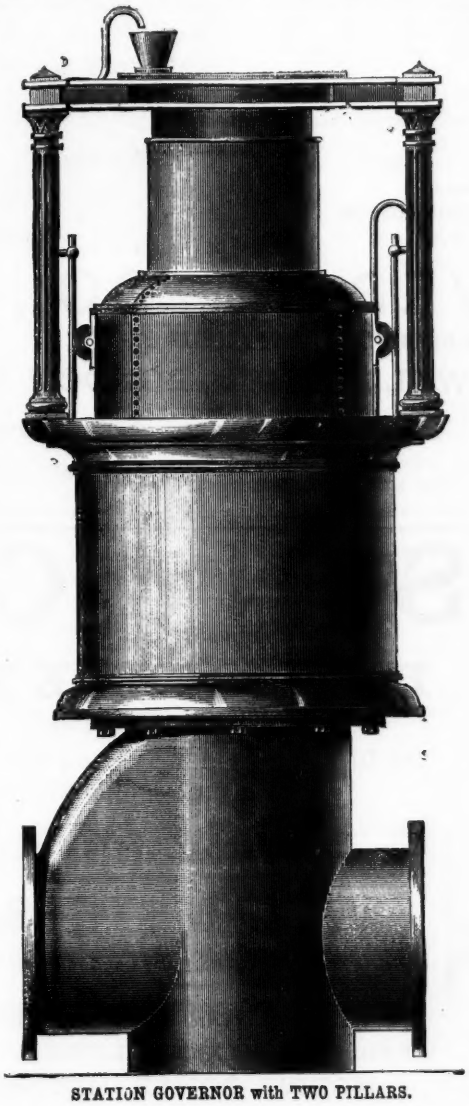
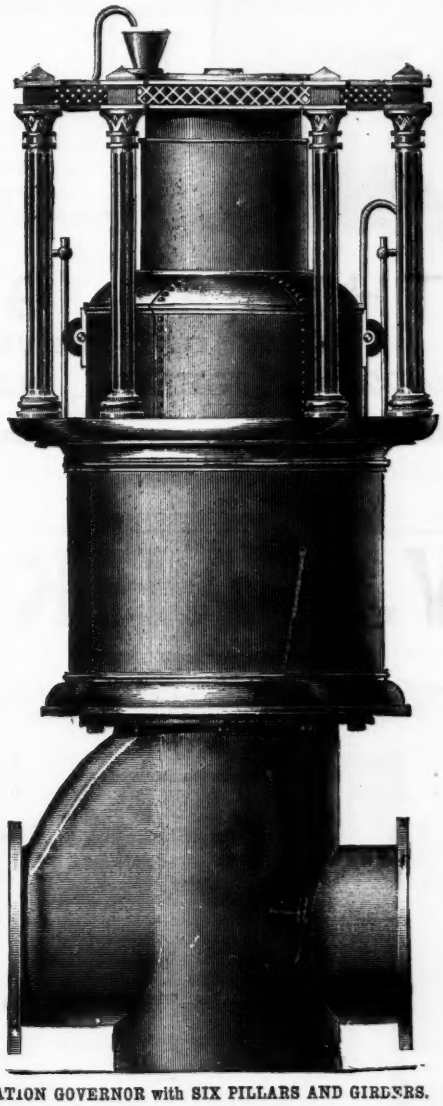


STATION GOVERNOR with TWO PILLARS.



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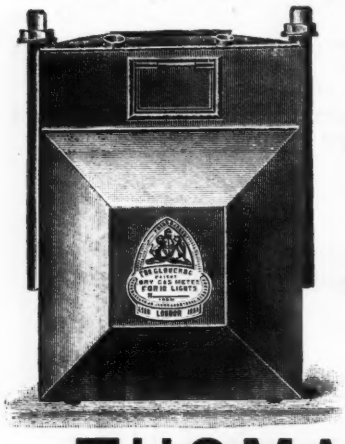

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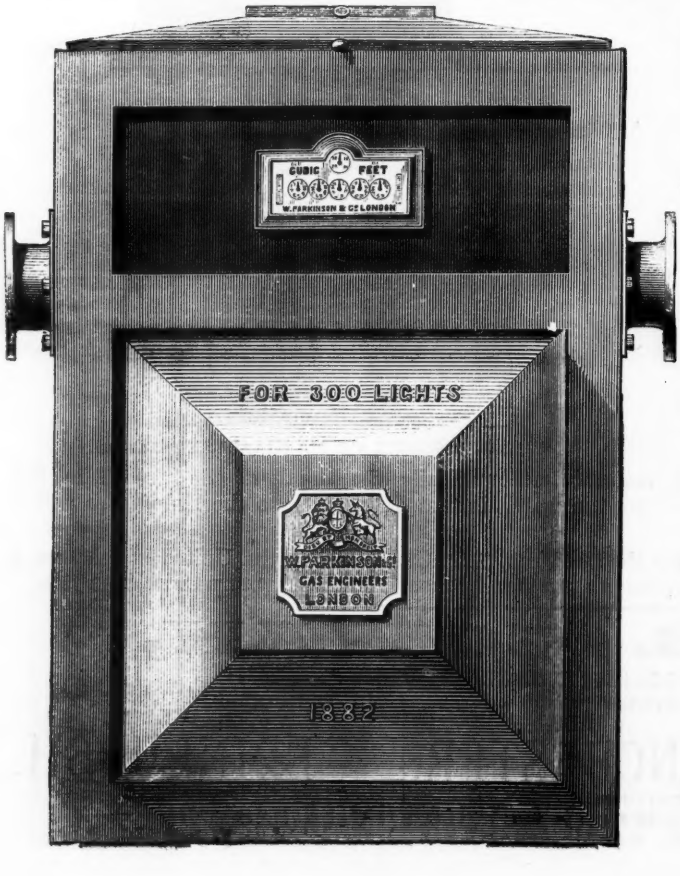

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 3, 1892.

Labour Topics.

THE wretched farces that have been played in the North of England during the past few weeks by Unionist miners and fitters, are among the most distressing incidents of an agitated time. One of these performances—the strike of engineers on the Tyne and Wear—has collapsed, after causing immense suffering and irrecoverable loss, leaving the original matter of dispute exactly where it was. For twelve weeks nearly 20,000 workmen have been absent from their ordinary employment, and it is calculated that they have lost thereby £180,000 in wages alone. "Great "loss has also been caused to the employers, many shop- "keepers have been reduced to a state of bankruptcy, there "has been a serious drain upon the funds of various Trade "Unions, and hundreds and thousands of people have only "been saved from starvation or the workhouse by public "charity." All this has resulted because two Trade Societies—the Amalgamated Society of Engineers and the Plumbers' Society—could not agree as to whether some pipe-fitting on board ship was plumbers' or engineers' work. People who hastily assume that Trade Unions do nothing but protect workmen against the rapacity and tyranny of employers, may be recommended to correct this impression by the facts of the East Coast engineers' strike. In this case, the employers had at first absolutely no interest in the dispute. They did not care what class of men did the work in question, so long as it was done. But the trouble was brought about wholly by the arbitrary action of the engineers, who number thousands to the plumbers' hundreds. When trade was good, the engineers refused to touch pipe work, which they then said was a branch of plumbing. When trade grew slack, however, they wanted to take the same work away from the plumbers; and this was the origin of the strike and lock-out, which began about the end of January, and has only terminated within the last fortnight. As the time passed in enforced idleness, one set of supporters after another fell away from the men's Strike Committee, who showed a strange determination to continue the strike long after its origin and motives were seen to be absurd. As *The Times* Newcastle correspondent puts it, the Committee "succumbed at last to the unanimous "denunciations of the press and the public, to the demands "of the London Executive of the Amalgamated Society of "Engineers, and to the manifest discontent of those "on strike." Unfortunately, however, the consequences of such treasonable folly to the cause of trade and labour as that which has just been suppressed at Newcastle remain for long after the error has been abandoned and repented of. It is not within the power of trade unionists to ensure that the work they lay down when they go out on strike is there to take up again at their own sweet will. Contracts cannot be played with in this way; and so it is not surprising to hear that in very many instances when the strikers of the Tyne and Wear professed themselves willing to resume work on the old terms, there was no job for them on any terms.

In contrast with the Tyne and Wearside strikers, who were kept idle by their Executive, the Durham miners have refused to permit their Union leaders to settle terms for a resumption of work with the employers; and the latest news from this afflicted district is that so many works dependent upon coal have been stopped, that the prospects of the coal trade are worse than ever, so that an even greater reduction of wages than the men stood out against at first will have to be submitted to before coal-getting can be resumed. It has been asserted that the effect of this change in the state of the coal market may be to prolong the strike until June. However this may be, the spectacle presented by the strikers, in trying to prevent the pumping out of mines, in resorting to violence against individuals whom they regarded as their opponents, or merely for having put before them unpalatable facts, has been a truly lamentable one. Mr. Burt, M.P., told the delegates composing the annual conference of the Miners' National Union, which recently met at Durham, some home truths, for which he has, of course, been hotly abused by the Anarchist section of self-styled Labour politicians. He has found it necessary to tell the miners, as though they were news, some of the most elementary points of what should be the behaviour of a free man in a free country. Thus, he assures his hearers that they must learn to respect freedom in debate, and must school themselves to listen patiently to remarks which they may for the moment consider as being opposed to their interests. Mr. Burt reproves his class with being impatient of sliding scales of wages and prices, and rejecting arbitrations when awards go against them; just as though they were children who would revenge themselves upon the barometer when the weather turns out less propitious for their purposes than they could wish. It seems strange that men who have votes can need talking to in this style; but it is one of the curious features of the modern Labour Movement that the workman is continually being assured by the demagogues who aspire to live by and upon him, and who climb to notoriety over his shoulders, that the New Unionism is quite independent of such old-fashioned conditions as legality, reliance upon truth, obedience to

obligations willingly incurred, and other restraints to which employers and other inferior animals are subject. Consequently, there is nothing the unionist workman "rightly struggling to be free" from a supposed state of bondage to his employer requires to take more closely to heart than the proper appreciation of the duties of a free, responsible citizen. When one hears the vile trash that is habitually poured forth by some mass-meeting orators—the intemperate appeals to selfish and sordid impulses, the hollow flattery of the "many-headed," the misrepresentation and slandering of honourable men, and the bitter denunciations of workmen who decline to support the speakers—the marvel is, not that strikers are commonly wilful, and occasionally given to violence, but rather that they do no more mischief. True, they are overawed by the rest of the community. But we take leave to suggest to such Labour leaders as are really and truly desirous of seeing workmen succeed to the place in the nation which their numbers would seem to warrant, for the honest purpose of contributing towards the solution of the problem of Poverty, that a little true wisdom in trade councils, a little magnanimity in common things, a little reverence on their part for "the eternal laws of God which know no change," will go farther in establishing the credit of the Labour Party than any number of the gaudiest banners and the brassiest bands that could be convened for a May Day celebration n Hyde Park or anywhere else.

The Meeting of the Incorporated Institution of Gas Engineers.

THE programme for the forthcoming session of the Incorporated Institution of Gas Engineers has reached us; the adjourned general meeting being fixed for Wednesday and Thursday, the 11th and 12th inst., at the Institution of Civil Engineers, under the presidency of Mr. Charles Hunt, of Birmingham. It is notified, in the circular convening the meeting, that advance slips of the papers to be read will be obtainable a few days before, so that members desiring to take part in the discussion of any subject will be able to prepare their remarks with full knowledge of what the writers have to say—a decided step in the right direction. Seven papers are included in the two days' *agenda;* and, in addition to these, there will, of course, be an address by the President. Mr. George Livesey will contribute a paper on the "Failure of the Wages System of Payment, and the "Remedy—Profit Sharing," which ought to arouse an interesting debate; the author's well-known views on the subject being as yet almost peculiar to himself—that is, if belief is to be gauged by practice. Mr. A. F. Browne, of Rotherhithe, is to follow with a memorandum on "Oil Gas Manufacture." Professor V. B. Lewes will also give a paper on the "Use of Oil for Carburetting Gas;" while Mr. T. S. Lacey, of Pimlico, will contribute some "Notes on the "Enrichment of Coal Gas with Liquid Hydrocarbons;" and Mr. E. L. Pryce will descant upon the "Comparative Value of Oils for the Purpose of Enriching Coal "Gas." The above are to constitute the first day's work. In the evening, the annual dinner is to be held at the Holborn Restaurant. Next morning, the "Technology "of Water Gas" will be expounded by Messrs. T. Goulden and A. M. Paddon; and the last paper on the list is a "Description of a Six-Lift Gasholder and Tank at East "Greenwich," by Mr. Frank Livesey. The day will be filled up by visits (by steamer) to the Tower Bridge works and the East Greenwich Gas-Works; all the necessary arrangements being made by the President. The South Metropolitan Gas Company will entertain the visitors at East Greenwich. It will be seen that the programme for the two days is a very full one. The questions of the day have been kept in view by the Council in accepting contributions; and there should not be much left to be said about oil gas, carburetted coal gas, or water gas, after the five papers devoted to different aspects of the general subject have been read and discussed. Evidently, the meeting will not be so fruitful in Transactions of an engineering cast as last year's; but obviously chemistry must have an innings occasionally. In the report of the Council, issued with the circular, it is stated that during the past year 45 applications for admission into the Institution have been received. This in an eminently satisfactory sign of the estimation in which the organization is held by the class of professional men for whom it was formed. The financial position of the Institution also is described as satisfactory. Certainly, if there is any taste among British gas engineers for the cultivation of a technical gathering where professional matters can be discussed without being overshadowed by any other kind of attraction, the Institution should be sufficiently severe and businesslike to meet the want.

The Meeting of the North of England Gas Managers' Association.

THE gas managers of the North of England had a very successful meeting on Saturday; a good assemblage coming together, under the presidency of Mr. R. Wallis, J.P., to hear some decidedly interesting and valuable papers by Mr. V. Wyatt and Mr. W. J. Warner. Mr. Wyatt had two contributions—one being a substantial address upon "Anomalies in Gas Undertakings," composed in the philosophic vein often affected by this talented engineer; and the other a brief but important sequel to the paper of 1889, in which the author suggested a sectional method of constructing gasholder-tanks. This communication proved that Mr. Wyatt's suggestion was no mere "pious opinion," but was intended to be carried out, as opportunity served. The opportunity came at the Redheugh works; and Mr. Wyatt seems perfectly satisfied with the results of his experiment. It may, therefore, be said that the new method is another step forward in concrete tank construction. Besides other considerations, the plan is to be commended for saving the earth in which the excavation is made, from the long exposure to air inevitable with trench work, which is extremely mischievous in the case of most sorts of clay. Whether concrete tanks should be formed at all in tough clay is another matter. Mr. Warner's paper was a very worthy production indeed, and would of itself have redeemed the meeting from the reproach of being common-place. Briefly stated, it was the author's object to show that the sliding scale in gas-works regulation ought to be used very much more freely than is ordinarily done. Mr. Warner is no believer in the generally-accepted policy of spending reserves in order to maintain prices and dividends at a steady point. He would have them fluctuate in closer agreement with the varying conditions of the undertaking; so that the public may feel that there is something in operation to govern the policy of gas directors. He does not lose sight of the value of constant rates of dividend to those who have to go frequently into the Money Market; but he puts the question whether the sliding scale ought to be held so far in the background as it usually is, and whether it would not be better to have more frequent recourse to it. The point is well taken; and we may rest assured that it will not escape the notice of some of the most eminent gas-works administrators.

Discontent in Boston.

THINGS seem to be anything but comfortable in regard to the gas supply of Boston, Massachusetts, where the ingenious Mr. Addicks reigns over the remnant of a Gas Company which once boasted itself as secured in its position more by virtue of the fairness of its dealings than by statute or guarantee. Only those fortresses are invulnerable, however, which have never been seriously besieged. A time came when the eye of the "raider" was attracted by the remarkable spectacle, for the United States, of a large city supplied with gas by one Company, which was selling at a low rate, and doing reasonably well by all parties. Such a state of things was clearly scandalous, and Mr. Addicks felt a call to show the local aldermen and others a more excellent way. After having been repulsed several times, the raid succeeded only too well; and Boston awoke one morning to find itself blessed, or cursed, with two Gas Companies where one had been sufficient for all practical purposes. How the trick was done will never be known. Mr. Addicks is apparently a skilful operator; and his backers were not men to stick at the price of an alderman or two, when it came to the point. The treachery of the aldermanic body was, of course, veiled at the time in the usual specious phrases about the benefits to be expected from competition in gas supply as in other matters; and so the transaction was concluded without, in all probability, the Boston public becoming conscious of the fate prepared for them. Of course, nothing was farther from the mind of the astute Addicks than competition, in the natural sense of the term. He was obliged to start a new Gas Company as a means of introducing himself into the city, and with this Company, which was himself "writ large," he, in another capacity, made a contract, of gorgeous appearance, for the construc-

tion of gas-works. He did buy a piece of land, it seems; but this bit of real estate, and his parcel of aldermen, were all his gas-making preparations at the commencement of his campaign, which ended in the capture of Boston. A brilliant stock operation, of the nature only too familiar to our Transatlantic friends, whereby the capital of the old Boston Company was "watered" sufficiently to recoup Mr. Addicks for his trouble and outlay, completed the victory of this clever gentleman, who now occupies the dignified and lucrative post of Treasurer of the Boston Gas Company, keeps his yacht, and is universally respected in the super-select society of the "hub of the universe." It is quite an improving tale of the "Good Young Man who "didn't Die" type; but, unfortunately, it is not yet finished. Boston is awaking to the consciousness that it is paying $400,000 a year more for its gas than would have been necessary if the genial Addicks had bestowed his expensive favours elsewhere; and so a number of the largest consumers are moving the State Legislature to see if they can upset him. We do not for a moment suppose that these proceedings, which are connected with the Boston gas news reported in last week's JOURNAL, will seriously hurt Mr. Addicks, or even cause him very much uneasiness. Capital, however obtained, is too sacred a thing for State Legislation to meddle with for the mere sake of public interest. These things are rather amusing, however, and certainly tend to bear out our old opinion, that the gas managers of the United States have a good deal to think of besides the plain technical matters which employ their British brethren. For what conceivable fraction of responsibility in fixing the price of gas can be ascribed to the gas manager's technical work, in face of the vagaries of such disturbing causes as that which, in the case of Boston, is represented by the modern Aquarius —J. E. Addicks?

Mr. R. G. Shadbolt, Assistant-Manager at the Fleetwood Gas-Works, has been appointed Engineer and Manager to the North Bierley Gas Company.

Dr. S. Rideal has been appointed Gas Examiner for the area under the control of the Lewisham District Board of Works, in succession to the late Mr. C. Heisch.

The Metropolitan Gas Companies' Accounts for the Past Year were presented to Parliament last Tuesday, in accordance with statutory requirements, and ordered to be printed.

The Recent Re-Assessments and the Cost of Public Lighting.—The South Metropolitan Gas Company have informed the Woolwich Local Board that, in consequence of the Board having increased the Company's assessment, the price for the public lamps will be raised from £3 3s. 9d. to £3 9s. per lamp per annum; but if the higher assessment is not enforced, there will be no change in the cost of lighting.

The Huddersfield Corporation and Inclined Retorts.—A deputation of the Gas Committee of the Corporation of Huddersfield, accompanied by their Engineer (Mr. W. Ralph Herring), journeyed to Brentford last Wednesday, and, by permission of Mr. Frank Morris, inspected the system of inclined retorts (112 mouthpieces) as worked by the Brentford Gas Company. The Chairman of the Committee himself charged one retort in seven seconds; and the deputation were thoroughly satisfied with the working of the system.

An Important Discovery of Rich Coal at Launceston (Tasmania).—The prospectors employed by the Mole Creek and Zeehan Mineral Prospecting and Exploration Company, Limited, recently brought in, for the inspection of the shareholders of the Company and for analysis, some heavy samples of cannel coal, or oil shale, which they reported had been discovered in outcrops of scores of tons on the surface. Some of this coal was submitted to the Engineer of the Launceston Gas Company (Mr. T. S. Cleminshaw, Assoc.M.Inst.C.E.), who tested it in regard to its value for gas-making purposes, and reported as follows: Quantity of gas (average of four tests), 11,200 cubic feet per ton; illuminating power (average of three tests), 50·40 candles. The residue was non-coking, and valueless for fuel purposes; being similar to the coke produced by the richer sorts of cannel. Its volume was 55·5 per cent. When broken, the sample exhibited signs of being an outcrop specimen; and water was visible internally. The tarry vapours, from their appearance, indicated the presence of oil. Mr. Montgomery, the Government Geologist, after inspecting the specimens, pronounced the discovery a most interesting one for Tasmania. The quality of the gas produced shows 2 per cent. higher illuminating power than that of the best kerosene shale of New South Wales; and the quantity will improve as it gets under cover. The value of the coal as a marketable commodity for gas-producing purposes in the colonies is now considered to be in every sense assured; and it is confidently believed that it will also produce oil in very large quantities.

WATER AND SANITARY AFFAIRS.

As the preliminary statements of the London Water Companies have now been sent in, though some of them not until yesterday, it may be hoped that a commencement will be made in the reception of evidence at the meeting of the Royal Commission on the Metropolitan Water Supply to be held to-day. Other public bodies, including the County Council and the Corporation, have been asked in like manner for documentary statements. The result will be interesting, especially as the proceedings of the Commission will be open to some portion of the Press. The Water Companies have a strong case; and they have every reason to court publicity. Their opponents have had a long hearing, while the Companies have made no reply, except in the shape of a speech from a Chairman at a half-yearly meeting of shareholders, or a few remarks in the course of a parliamentary debate, with occasionally, but very rarely, a letter from an independent correspondent in *The Times*. The Press, as a rule, has been hostile to the Companies; and the editorial pen has attacked them without stint. Calm and judicial inquiry may now be expected to dissipate many fallacies, and to abate the force of prejudice. Concerning the New River Company, which, despite the title, is by far the oldest of the eight—some striking facts are likely to be elicited, showing the enormous supply which the Company are able to draw from their deep wells. Such are the resources in this direction, coupled with the volume now taken from the Lea, that there is every prospect the Company will be able to cope with the demand for the next forty years, supposing the population to go on increasing at the same rate as for some years past. If in future the growth of the population is maintained at only the same rate as for the last two years, the supply will hold good for more than half a century. If facts like these are fairly demonstrated before the Royal Commission, there will be little room left for the contention that London is under any necessity to expend millions of money in order to get a supply from Wales or the West of England. Not only the New River Company, but all the Companies supplying London and its suburbs, will be able to show resources far beyond what the County Council have seen fit to allow. At the very utmost, taking the case of the Thames, all that may be needful in the shape of novelty will consist in the provision of compensation water. Unquestionably there is water enough, only some of it comes at the wrong time. Another point is the question of monopoly. We believe we are right in saying that there is a clause in the Charter granted to the New River Company, by which it is provided that no water may be supplied to London or Westminster except with the consent of that Company. It may be presumed that the Company have consented to what has been done in other districts than that which they now serve; but the mere existence of such a clause is sufficient to show the legal basis on which the water supply of London has been established. Parliament may abrogate the clause; but it has not yet done so.

The monopoly of the water supply is keenly discussed by correspondents in *The Times;* and we do not know but what Colonel Makins has conceded rather more to his opponents on this question than was needful. Assuredly, the water supply of London is in the nature of a regulated monopoly, in the exercise of which the Companies possess a statutory guarantee so long as the prescribed conditions are fulfilled. One of the disputants, in reply to Colonel Makins, evidently apprehends this point. He endeavours to show that "the obligation to provide water has already been "violated;" and he expects that this will be proved in evidence before the Royal Commission. We can expect nothing of the kind, seeing that the domestic supply per head in the Metropolis far exceeds that of several large towns in the kingdom, and is really lavish in its abundance. Supposing it could be shown—which we do not at all anticipate —that one Company has experienced some difficulty in keeping up the supply, is that to be a reason for disestablishing all the rest? If, on the other hand, it is shown that the Companies have fulfilled their obligations, the principle comes into operation which the objector has himself admitted—that Parliament will grant compensation on the profits earned in the case of the Companies loyally fulfilling their duties. The opponent can be successfully met on this ground, and compensation claimed accordingly. Yet there is another barrier raised against justice being awarded to

the Companies. When they have done all that they were required to do, they are to be pronounced unprofitable servants, because it is assumed in certain quarters that they will not be able to fulfil their duties at a future date. It is argued that if a jury are assessing the value of a going concern, with no very heavy outstanding engagements, they fix one price; and if they are valuing a similar business with a heavy bill coming due at the end of a few months or years, they fix a very different price. But the Water Companies have no heavy bill coming due. They are in the position of a tradesman who has to enlarge his premises and to embark additional capital from time to time, in order to conduct his business on a more extensive scale. As for the ability with which the Metropolitan water undertakings are conducted, Colonel Makins offers a weighty consideration when he says there is much more danger of jobbery and extravagance where public money is being expended by elected councillors, than when there exists the personal interest of investors who work for a profit, as a stimulus to economy and careful management. Had the Metropolitan Water Supply been in the hands of a County Council from the beginning, we venture to say that the consumer and the ratepayer would alike have suffered.

Mr. Ralph Fearnley, of Rastrick, has been appointed Manager of the Chorley Corporation Gas-Works.

The Murdoch Memorial.—The Committee in charge of the Murdoch Memorial, through the Secretary (Mr. James M'Gilchrist, of Dumbarton) have commissioned Mr. D. W. Stevenson, R.S.A., Edinburgh, to execute in marble a bust of William Murdoch, the Inventor of Gas Lighting, to be placed in the Wallace Monument, where he will be in the company of his friend and partner James Watt. The model is already prepared, and has been approved of by the Committee; and the bust will be unveiled this year—the Centenary of Gas Lighting.

The First Visible Colour of Incandescence.—Writing to *Nature* on a recent occasion on the subject of the first visible colour of incandescent iron, Mr. T. C. Porter describes how he tried a similar experiment with the carbon filament of an ordinary incandescent electric lamp. For this purpose he employed an 80-volt Edison-Swan 16-candle lamp; and the method of heating it gradually was to pass a current, supplied from a battery of accumulators, through the lamp and a water resistance, which latter was gradually reduced by the addition of sulphuric acid. The room in which the experiment was performed was very carefully darkened; and the observers were kept in darkness some minutes before the current was switched on. As the current was increased by regular stages, the observers (25 in number) carefully inspected the lamp in rotation, and every one of them wrote down his impressions of the colour of the filament in the dark, so that their eyes were not affected by extraneous light. Of the whole body of observers, all agreed that the colour of the filament was at first very pale. Thirteen called it a very pale yellow; three termed it white; seven, a faint pink; two, a bluish white. All agreed, also, that as the temperature rose, the colour grew deeper and redder; passing through orange *before* arriving at crimson. The words used to designate the final tint reached in the experiment varied from deep reddish orange to copper colour, dark red, blood red, crimson. In diffused daylight this would be called a dull red.

A Remarkable Gas Explosion.—A remarkable gas explosion is reported in the columns of our contemporary *Engineering* by Mr. J. H. Apjohn, Vice-Chairman and Engineer to the Calcutta Port Commissioners, illustrating the way in which light carburetted hydrogen may sometimes occur in unexpected places. It is stated that in July, 1890, a vessel loaded with vegetable produce of various kinds, and ready to go to sea, was sunk at her moorings in Garden Reach by another vessel running into her. For local reasons the wreck was suffered to lie where it sank; being duly marked with buoys. Eighteen months later, another vessel happened to strike the wreck with her bow, as she was being turned preparatory to leaving the port, and within a very short time afterwards, variously estimated by the different witnesses at from 45 seconds to 4 minutes, an explosion occurred in her forecastle, where the crew were at the time having their breakfast, which killed two of them on the spot and so seriously injured the rest that seven more subsequently died in the hospital. The suggestion was offered that the explosion was due to foul air from the wreck, which at first seemed to Mr. Apjohn to be incredible; but, on looking into the matter, he found that this was undoubtedly the cause of the accident. Bubbles rising from the wreck were found to consist of marsh gas; and it was discovered, upon examination of the second vessel, that in touching the sunken ship she had torn a hole in either bow, through which, during the momentary period of contact of the two vessels, sufficient marsh gas from the decomposing submerged vegetable matter had entered to form an explosive mixture with the air in her forepeak. This ignited at the nearest light, with the result recorded. The incident is perhaps the most extraordinary explosion of inflammable gas to be found in technical annals.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 814.)

THE revival of business on the Stock Exchange still remains postponed *sine die*. The past week was quiet and humdrum; the settlement (which was not heavy) enjoying all attention, and fresh business being but lightly entered into. Purchases for investment progressed; and this class of business received an additional fillip when the Bank rate was, somewhat unexpectedly, reduced to 2 per cent. from the 2½ per cent. rate fixed on the 7th of April. Two per cent. is the Bank minimum rate; and it is just four years since it last obtained—the rate stood at 2 per cent. from the middle of March to the middle of May, 1888. As far as can be foreseen (but that is not much), there is no reason why the minimum rate should not hold good for many weeks. Business in the Gas Market has been rather dull; and movements have been somewhat contradictory and irregular. The chief feature was the flatness of Gaslight "A." The tendency to weakness evinced the week before was confirmed at the opening; and a further fall took place. Prices gave way pretty well every day, until the quotation closed at 202-207, with business marked at 203. Moderate transactions were effected in the debenture, preference, and limited issues, at steady figures; "J" being the strongest at a further rise of 1. South Metropolitans, on the other hand, though not active, were very firm; and the "A" advanced 3. But no business was done in it. A few transactions were marked in Commercials at low figures; but the corner is probably turned by this time, and those who have been shrewd enough to buy in the falling market will reap the benefit. The Suburban and Provincial undertakings remain very quiet and uneventful; the only move being an advance of 1 in Brentford new. The Continental Companies are firm and quiet; the principal issues being unchanged. But Continental Union preference has made an improvement of 2½; and Cagliari rose 1. Of the Indian Companies, Bombay was in fair demand at good prices; but Oriental has been inactive. Among the South Americans, nothing has moved but San Paulo, which recovered ½. Water has settled down; and very little business was done in any of the Companies. The tendency remains favourable; and one or two further advances of slight extent have been effected.

The daily operations were: The Gas Market was extremely quiet on the opening day; and little beyond a few transactions in Gaslight "A" was marked. The latter was weak, and fell 2½. Business continued very restricted on Tuesday. Gaslight "H" and "F" were done at medium prices; but "A" was not touched, and quotations did not move. In Water, Chelsea advanced 2. There was decidedly more activity on Wednesday throughout the Gas list; and an advance of 2½ was effected in Continental Union preference, and of 2 in Brentford new. In Water, both Lambeth issues advanced 1. On Thursday, Gaslight "A" receded afresh, with a fall of 2½; but the "J" rose 1. South Metropolitan "A" also improved 3; and Cagliari, 1. On Friday, a further fall of 1 was marked in Gaslight "A;" but San Paulo recovered ½. Saturday was an especially quiet day, in view of the Exchange being closed on the following Monday; but Gaslight "A" contrived to recede 2 more.

ELECTRIC LIGHTING MEMORANDA.

Local Authorities and Electric Lighting Orders—Choking Coils and Regulator Lamp Sockets—The Illuminating Power of the Bath Arc Lamps—The Metropolitan Electric Supply Company—Mr. Preece on the Union of Electric Lighting and Water Supply.

THE ways of municipal corporations having Electric Lighting Orders to carry out are a grievance to our contemporary the *Engineer*, as they doubtless are to a good many other people with a more immediate interest in the practical working of the Act. It is complained that when corporations are in possession of Electric Lighting Orders which they have finally made up their minds to carry out themselves, instead of calling in an electrical engineer, to make a design for the necessary plant, they often adopt the trick of inviting tenders from competing firms of electrical contractors, with the result that a great deal of money is spent to waste by the latter upon unsuccessful tenders. This money they naturally try to save from somebody; and so it happens that when any firm of contractors do manage to get a corporation contract, with no engineer to look after them, they usually succeed in putting in so many "extras" that the ultimate cost of the plant is found to be unnaturally enhanced thereby. "Thus eventually the ratepayers have to stand the cost of all the muddle and waste engendered by a loose system of tendering and contracting for public works." Our contemporary therefore concludes that it would be much better if, instead of asking for designs and tenders, local authorities contemplating electric lighting would employ competent engineers to plan the installation beforehand, just as is done with most other public works. This contention is reasonable enough; but it appears to us that our contemporary loses sight of the initial difficulty

that besets a local authority embarking upon this kind of enterprise, which is, to find a reliable adviser who can be depended upon to deal with their Order on its merits, and not make it a peg whereon to hang his own preconceived ideas. They really want to know which is the best system of electrical generation and distribution to adopt, before calling in anybody; because when they have once got into the clutches of Professor A., or Mr. B., or Dr. C., he will be certain to recommend his own pet system, whatever it is. This difficulty does not exist in anything like the same degree in other branches of engineering.

There has been some little discussion lately in electrical engineering circles upon the subject of so-called "choking coils"—which have no connection, be it understood, with any device for executing criminals by electricity. They appear to be something like transformers, inasmuch as they take off a portion of the charge from the conducting wire to which they are applied. Practical use is made of these "choking coils" in the construction of certain regulator sockets for incandescent lamps, in which the possibility of lowering the light is the chief recommendation. Our contemporary the *Electrician* has made a calculation of the difference in cost which may be expected between the use of a regulator socket for reducing the light emitted by a lamp, and simply shading it to the same degree by a screen. According to this computation, there should, upon a lighting period of 2500 hours, be a balance of about 6d. in favour of the regulator socket. But as the socket itself may be supposed to cost something extra, there can hardly be much real economy attending its use. It seems scarcely likely any noticeable saving can be secured by turning down electric lamps till the problem of storing electricity is solved; and then a great many other things will happen.

The Electric Lighting Committee of Bath have had the illuminating power of their street arc lamps tested by an independent examiner, with the result that the nominal 1200-candle power lamps are reported to be quite correctly described, but that this quantity of light only applies to the performance of the naked arc, and does not represent the net lighting effect produced after allowance is made for the loss by ground-glass or opal globes. With regard to the absorption of light by the latter, it was ascertained once more that clean ground-glass globes stop from 42 to 46 per cent. of light, and opal glass stops from 54 to 70 per cent. when clean, and more when dirty. Seeing that lamp-glasses generally are dirty, and that ground-glass especially can hardly be satisfactorily cleaned when it has once become grimy, it would appear that the citizens of Bath may think themselves lucky if they get one-half or even a quarter of the nominal amount of light radiated from their arc lamps. We are, of course, not surprised at this; but when nothing of the kind is mentioned at the time of giving out the electric lighting contracts, but the degree of proposed illumination of the streets is expressed in terms of the brilliancy of the naked arcs, it is only natural that the citizens should feel a little aggrieved at the result.

The Metropolitan Electric Supply Company is the second largest venture of the kind in London—indeed, since the London Electric Supply Corporation have been so hindered by their misfortunes, the Metropolitan may be ranked as the most considerable. This is a concern which has not "all its eggs in one basket;" but maintains several stations supplying current upon the moderate high-pressure system from centres near Lincoln's Inn, Holborn, and Oxford Street. They have another station in hand in Paddington. Altogether, the Company have spent £486,926 upon capital account, and have come to the end of their tether, so they propose to raise £100,000 more by the issue of debentures. Here again, therefore, may be seen the not altogether satisfactory spectacle of an open capital account while the money already sunk is not so productive as could be desired. Still, it is clear enough that, until an electric lighting district is fully wired, it is impossible to say whether it will prove profitable to work, or the reverse. The net revenue of the Metropolitan Company for last year was £9720, out of which the Directors recommended a final dividend of 2s. a share.

Mr. W. H. Preece has been lecturing before the Liverpool people upon the interesting subject of the utilization of the waste forces of Nature—of course, with particular reference to the possibilities of cheapening electric lighting by obtaining this form of energy from other sources than the heat of burning coal. He specially appealed to his audience by referring to the waste of the power which will be represented by the loss of head in the Vyrnwy aqueduct. The total energy continuously expended by the water in its fall from Lake Vyrnwy to Liverpool will be about 7000-horse power. While admitting that much of this will be disposed of as friction, Mr. Preece remarked that "it is well worth the consideration of our water authorities whether some utilization of this wasted energy in water-works generally cannot be effected so as to deliver it in the form of electrical energy in our streets and buildings. The whole of the streets of Liverpool could be brilliantly lighted by the energy wasted in the Vyrnwy aqueduct." It has often been urged that electric lighting ought to be combined with the gas supply of towns; and we have never been able to accept this view of the case as altogether the correct one. To make electric lighting a branch of a gravitation water supply is, however, another and a totally distinct suggestion; and we shall be pleased to help in shifting the responsibility for cheapening electric lighting from the shoulders of gas engineers to those of their water brethren.

A MEMOIR OF MURDOCH.

In last week's JOURNAL, reference was cursorily made to a little book about Murdoch, the inventor of gas lighting and of a great deal besides, written by his descendent, Alexander Murdoch, of Pollokshields, and now on sale for the benefit of the Murdoch Memorial fund,* which, as is well-known, is under the control of the North British Association of Gas Managers. It is unnecessary to discuss here the claims of the inventor of gas lighting, whoever he might be, to a national memorial. If the recognition by society of its benefactors were always gauged proportionately to the material good done by, and in consequence of, the acts of the latter, it is hard to say what bounds should be set to the commemoration of such names as those of the first man to apply coal gas to the purpose of lighting, or the discoverer of the method of maintaining roadways in a usable state, or any similar practical improver of the conditions of civilized existence. By what is doubtless a wise, as it certainly is a deep-seated discrimination in these matters, however, the world does not care to memorialize these useful persons in the same way as it does its heroes of peace or war, or its prophets and teachers, spiritual and secular, who would scarcely, as a class, rank as merely "useful" in their age and degree. It is idle to deny or to overlook this tendency of mankind—it actually exists, and must be reckoned with; and a most striking illustration of the fact is to be found in the circumstance that it has been left for the North British Association of Gas Managers to petition for a resting-place for the portrait-bust of their ingenious prototype in the interior of the monument which impresses the memory of Wallace Wight upon the perceptions of all visitors to the spot which is so deeply hallowed by the most momentous incidents in the long tragedy of Scottish national history.

When one ponders these things, one can in a little time understand how the deep conscience of mankind works with regard to them. It is impossible to weigh in the same scale, or to reward in the same kind, the deliverer of a nation and the discoverer of a new industrial process. Take it how we may, the latter proceeding is something "in the way of business," the production of which does not necessarily argue any sort of merit in the person whose name happens to be identified with it in industrial chronicles. The world looks at an inventor in this way: He is successful and makes money, in which case he has his reward; or he is unfortunate, and for some reason fails of the recompense on which it is reasonable to suppose he counted. In the latter case, he is to be pitied; but his misfortunes rarely touch the hearts of his fellows differently from those of any other unsuccessful man of business. This may seem a hard saying to ears that have been seduced, by the flattery of such as are interested in patents, to believe that the inventor, *quâ* inventor, is the greatest benefactor of his species. It is a part of the superficiality of much that now-a-days passes current for common sense and worldly wisdom, to exalt the material and the useful at the expense of the real and the true; but, somehow, in Fame's long account with Time, these mistakes of an hour do not affect the final balance.

Now, bearing in mind what has just been said, it will be perfectly clear that the first name to be associated in technical history with the application of coal gas to lighting purposes might very well have been a name, and nothing more, in the estimation of posterity. Yet another reason besides those which arise from the considerations already advanced may be given in explanation of this statement. It is this: The world is growing ever more and more chary of taking at their own valuation, or that of their friends and partizans, the individuals who, personally or by proxy, claim to be able to say of anything under the sun "Alone I did it!" We appreciate the one-man power quite as highly as it deserves; but we no longer accept so readily as did our forefathers the proposition that the one-man power is to be credited with everything that, in the shorthand which we call History, is labelled by the name of a particular individual. Processes are the fruitage of ideas, and ideas come—who knows how or whence? At certain times particular orders of ideas are "in the air," and a man cannot tell how many sleeping partners he has in his own projects.

And so it is that something more than the crude reputation of having been the originator of a particular process, or the discoverer of a special application of a natural force or product, is needed to arouse our interest in a man. Suppose, for example, that the originator of gas lighting had been a mere guesser, like the man who first "struck oil" in Pennsylvania thirty years ago, and recently died in poverty and obscurity. Let it be imagined that the first application of gas to lighting purposes was a "lucky hit." Would there then be any reason to remember the name of the undeserving recipient of Fortune's favours? By no means. Although the first gas engineer had been the happy possessor of a patented specialty as productive of gold as the big oil monopoly of America, this would not warrant us in observing his centenary. Will the Big Panjandrum of the Standard Oil Company be remembered a hundred years hence? Perhaps, if he pays for the luxury; but hardly otherwise.

If Murdoch's name had merely come down to us as that of the man who first thought of putting the light of coal gas to

* "Light without a Wick. A Century of Gas Lighting; 1792-1892. A Sketch of William Murdoch, the Inventor." By Alexander Murdoch, of Pollokshields. Glasgow: R. Maclehose, 153, West Nile Street.

systematic use, it would have been fair to remember it as that of a striker-out of a new path for industry. It is conceivable, however, that there might have been no advantage in knowing any more of the bearer of the name. Just as, for the sake of rounding off the story, the historian of California sets down the name of the first man known to have found gold in the country, without treating the fact as necessitating his narrating the biography of the man, unless the finder happens to be a notable character in other respects. In the case of Murdoch, we are happily able to say that this Ayrshire millwright, who, like so many of his compatriots, "cam' Sooth" at an early age, and whose life-history attracts the sympathetic attention of the followers of the industry which he was the first to practice, well sustains, as a man, the interest which he arouses as an inventor. For this reason, we cordially recommend all those connected with the executive side of gas supply who read these lines, to procure a copy of Mr. Alexander Murdoch's little work, which will tell them what manner of man William Murdoch was, and some of the things he did; and we shall be content to be blamed as a false guide if those who take our advice—when they have gazed upon the strong, homely, kindly lineaments of the first gas maker, as reproduced in photogravure of the portrait by Graham Gilbert which forms the author's frontispiece, and have carefully read the simple story of the man whom James Nasmyth, with generous appreciation, described as "that incomparable mechanic . . . a man of indomitable energy, and Watt's right-hand man in the highest practical sense"—do not lay the book aside with the verdict: "Here was a man of men, whose invention of gas lighting does but serve to illuminate his mechanical genius and sterling character, for which, rather than for any particular fruit of his untiring industry and bold originality, may his name be ever held in honourable remembrance by those of his blood and speech; and may his spirit inspire all who follow in his steps to work as he did—honestly, skilfully, and modestly, with the materials lying readiest to hand—for a worthy end." We are grateful to the kinsman-author for this glimpse which he has given to us of a truly notable man. Such stories as this of Murdoch are good for the world to know. Here we may read how the gifted Scotch mechanic, who gave the world the germs of steam locomotion and gas lighting, not only received nothing for these epoch-making inventions, but was mercilessly snubbed and treated as a hack by his eminent, but apparently selfish employers, Boulton and Watt; how he outlived their indifference, and survived to see, indeed, his grandest productions returning gains and profit to others, but at least to enjoy in easy comfort the placid eventide of a well-spent life "with all that should accompany old age, as honour, love, obedience, troops of friends," and to see (as he must have done) in the growing of the industries which he initiated, the guarantee of his own lasting renown.

Dr. R. Thorne Thorne, F.R.S., has been appointed Principal Medical Officer of the Local Government Board, in succession to Sir G. Buchanan, F.R.S., resigned.

The Gas and Water Companies' Directory, &c.—The Editor of this useful work (Mr. Charles W. Hastings) asks to be allowed, through the medium of the JOURNAL, to request officials of gas and water companies, corporations, and local boards who have not yet returned the forms sent to them by him, to do so at their earliest convenience, in order that there may be as little delay as possible in the completion of the book. It is obvious that the date of its issue must depend upon the promptitude with which the statistics collected therein are supplied; and while thanking the large number of engineers, secretaries, and managers who, during the last fifteen years, have rendered such signal service by furnishing him with information, Mr. Hastings expresses the hope that this reminder to those who have not done so will bring a response from them, and enable him to publish, at an early date, the result of their combined labours.

Waverley Association of Gas Managers.—The 62nd half-yearly meeting of this Association was held on Thursday, the 14th ult., at North Berwick. Before commencing the business, the members and friends (who assembled in good numbers) visited the gas-works, under the guidance of the Manager (Mr. J. Black). They then proceeded to the Royal Hotel, where the meeting was held—Mr. J. Smith, of Rosewell, presiding. The Secretary read the minutes of the previous meeting; and they were approved of. The members then appointed Mr. J. Black, of North Berwick, President for the ensuing year; and Mr. G. Taylor, of Jedburgh, was re-elected Secretary and Treasurer. After a short address from the President, various subjects connected with the manufacture of gas were discussed—viz., leakage from mains, pressure on retorts, and the probable use of paraffin oil as a substitute for first-class cannel. At the close of the meeting, the members and their friends drove along the sea coast to Canty Bay. On their return, they dined in the Royal Hotel—Mr. Black presiding, and the croupier's chair was occupied by Mr. Smith, of Rosewell, the retiring President. The principal toast—"The Waverley Association"—having been duly honoured, it was responded to by Mr. W. Robson, of Selkirk, the oldest member, who afterwards presented the gold medal of the Association to Mr. Smith, by whom it was suitably acknowledged. The next meeting will be in September, at Peebles.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

First Volume of Transactions.

JUST in time to avoid the reproach of being too late, the first Volume of Transactions of the Incorporated Institution of Gas Engineers has appeared; thus marking the close of the opening year of a young, and, from one point of view, an experimental organization. We cannot go so far as to say that this volume, which has been so long in preparation, is really ill-timed in its appearance at the present juncture, when the gas engineering world is beginning to ask what the second annual meeting of the Institution will be like. Indeed, the book appears very appositely, and will serve as the best of all advertisements of the coming meeting. For it is only doing common justice to state that the volume now before us constitutes in itself the very best justification that could have been found for the creation of the technical organization of which it is the first-fruit. The opening meeting of the Institution, as we remarked at the time, was an eminently good and successful one, and must have amply rewarded the pains and anxieties of the moving spirits in the venture. There was much in connection with the meeting, however, which could hardly be appreciated at its full value even by those who attended the gathering, and would of course wholly escape the appreciation of absentees. We refer to the numerous and elaborate plans and diagrams illustrative of the papers, the sight of which, covering as they did the interior wall-surface of the lecture-theatre in Great George Street, was as bewildering and oppressive as it was tantalizing. We freely acknowledged at the time that Mr. Alfred Colson's paper upon the Leicester Gas-Works extensions, which was the masterpiece of the show, was the most complete, instructive, and altogether admirable production of the kind that had ever been brought before a gas engineering audience. But its very elaborateness and richness of detail militated against its being fully appreciated at the time. There is no practising engineer but would be glad to have such drawings to study whenever called upon to face the same problems as those dealt with by Mr. Colson; but the place to examine these plans, and to criticize with a view to improving upon them, was obviously not the meeting-room of the Institution. Having the responsibility, as well as the privilege, of publishing Mr. Colson's plans, and also the drawings illustrating the labour-saving machinery at the Kensal Green works, the oil and water gas experiments at Beckton, &c., it is not at all to be wondered at that the Council of the young Institution hardly knew what to do. Happily for their own credit and the reputation of the Institution, they decided to do the thing handsomely; and in consequence of this praiseworthy resolve, their first Transactions are enriched with no less than thirty-four folding plates referring to the Leicester extensions—thus making the volume of unique value among technical books. For this splendid set of drawings alone, it deserves to rank high among the text-books of gas engineering. We shall best do justice to the subject, perhaps, by declaring roundly our conviction, which no one who has seen the work will dispute, that no gas engineer can afford to be without a copy of it.

The question of the publication of Transactions of technical societies is a subject upon which we, in agreement with other journals which have a great deal to do with reporting this kind of literature, entertain very decided opinions. The world moves, even in regard to the performances of scientific and technical societies; and it is necessary for those outside observers who are in a position to feel the movement, to bring a sense of the facts home to the comprehension of the permanent officials of such societies, who are commonly routineers, and to the members of their councils, whose interest in the management is generally spasmodic and often perfunctory. Time was when scientific and technical societies were almost secret bodies. If they kept any record of ther discussions and transactions, these were only in manuscript form, and the outside world knew nothing of them. The collection of this information, and the printing of it for publication, was a very long stride in the way of progress; and it immensely increased the usefulness of the societies which adopted this principle. When they did this, however, and when the publication in book form of printed Transactions became a recognized duty of every respectable technical organization, there was no such thing in existence as a technical press, undertaking, in the ordinary way of business, the reporting of the doings of society meetings, and thus converting the Transactions of the latter into news. It cannot be denied that the appearance of the technical journal wrought a great difference in the relations between technical societies meeting in public and the outside world. It does not seem, however, that the policy of those who are responsible for the conduct of such societies has been modified in reasonable accordance with the alteration and improvement of their opportunities for reaching the wider public which cannot, by force of circumstances, attend meetings, and is not always prepared to purchase volumes of Transactions.

We do not propose to enter into a long discussion of this vexed subject now. The way in which technical societies treat the technical press is as various as the number of such organizations is large. Some take no notice of the existence of any other means of publication besides their own, whatever these may be. Others give every facility for the reporting of

their proceedings. Between these extremes, there are to be found examples of every shade of compromise. As we have argued in previous references to this question, it would often be possible for Councils of Societies to save a good deal of money in reporting, while ensuring the better and fuller transcription of their discussions into a technical journal, by co-operating with the best journalistic reporting agency. This remark, of course, applies only to such portion of the proceedings of a Society in public meeting which can be treated as news matter. After this comes the consideration of the Transactions, which must be published by, and on the responsibility of, the Society itself; since, if they are to be worth anything at all, they should comprise matter, drawings, &c., which no technical journal could afford to embark upon.

This is the reason why the present volume of Transactions of the Institution of Gas Engineers is so valuable and noteworthy a production—simply through the inclusion of plans and drawings which are not to be had elsewhere, and which, being published, are indispensable to gas engineers. For the rest, the book is neither better nor worse than others of its class. There is nothing new to be said respecting the matter of the papers and discussions, which were abundantly noticed at the time. It is certain that these Transactions set a standard of quality for the work of the coming meeting, which it will not be easy to live up to, much less surpass. Let us hope that, under Mr. Charles Hunt's presidency, the Institution will provide its members with another dish of technical fare not inferior to last year's production. The time is very near at hand when curiosity upon this head must be satisfied one way or the other, for the present year's meeting is to be opened at the Institution of Civil Engineers to-morrow week.

COMMUNICATED ARTICLE.

THE PRESENT POSITION OF THE GAS-WORKS RATING QUESTION.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

(*Concluded from p.* 747.)

The method of arriving at the fair rateable value of a gas undertaking, has lately been described in these columns by one of the best authorities on the subject—Mr. Thos. Newbigging;* and therefore I assume that the reader is well acquainted with the same, and that there is no occasion for giving detailed explanations or examples of it. Worked out with a due regard to the precedents established by custom, it affords a satisfactory result as judged by the above considerations. Without accepting or approving every detail of the *modus operandi*, it is capable of effecting a fair and just division of profits between the landlord and tenant. The average rate of dividend paid would be about 7 per cent. on the total paid-up capital, including debentures and premiums; and by means of this method of valuing, about 4 per cent. is awarded to the landlord and about 3 per cent. to the tenant. After taking off floating capital, preliminary and establishment expenses, and other items not rightly chargeable in the capital of the hypothetical landlord, the 4 per cent. would give him an actual 5 or 6 per cent., which is a fair rental; while the tenant's profit of 3 per cent. does not represent a higher figure than that which could be shown, from actual examples of gas-works let on lease, to be usual in practice. It is an old established formula with gas engineers, that a fair rateable value is something more than half the disbursed profits, or 3 to 4 per cent. on the total capital. Taken in connection with the price of gas, the profits represent from 10d. to 1s. 3d. per 1000 cubic feet, of which the rateable value covers 6d. to 8d. Taking the rates at 6s. in the pound, this amounts to a charge of about 2d. per 1000 cubic feet of gas sold.

So long as the rateable value remains at something under two-thirds of the actual profits—4 per cent. of the total capital, or 2d. per 1000 cubic feet of gas sold—gas companies would not complain. But of late they have had to contend, in many cases, with attempts to raise the rateable value considerably above these proportions—sometimes reaching as high as the total profits, and representing an actual payment of 4d. per 1000 cubic feet of gas sold. And this in the face of the fact that both the capital employed and the rates of profits divided, as compared with the output, are lower than they used to be. When the gas company appeals, their case is supported by the production of a valuation prepared on the lines just indicated. Against them professional valuers are put forward, who leave the final issue out of the question, but direct their attention to the details of the present method of valuing. They traverse the items of the revenue account, and throw out several as chargeable to capital; arriving at a sum for so-called net receipts that represents perhaps half as much again as the disbursed profits, and which if earned would be of no additional benefit, seeing that the law limits the amount to be divided. In effect, they propose to base the rateable value on a fictitious case that cannot exist in fact. Continuing to apply a similar process to tenant's capital and the landlord's deductions for wear and tear, they arrive at a result which leaves the tenant little or no profits at all. Sometimes they go so far as to award the whole of the available profits to the landlord, in which case it would follow that the tenant would not even get any interest on his capital.

At the time when the precedents generally accepted by gas companies and by the majority of assessment committees were established, it was a very usual custom to let gas-works on lease. In case of dispute arising, it was easy for either side to put actual lessees of gas-works into the witness box; and there is not much difference between a lessee and a hypothetical tenant under the Act, where a valuation is to hold good for a term of years. Under these circumstances, disputes could be settled by reference to existing facts. But the practice of letting gas-works on lease has now become almost obsolete; and so the inquiry must follow on theoretical grounds only—a state of things that is unfortunate for gas companies, as the opposition valuers are now in a position to gain credence for arguments that formerly would have been effectually disposed of. When once this method is attacked and subjected to modification, there is no saying where the innovations will stop. It is just as easy to prove on paper that the assessment ought to be doubled, as that it should be increased 10 per cent. Take for an example the 17½ per cent. on tenant's capital, which has lately become a favourite item of attack. There is no agreement as to the extent to which this factor should be reduced. Some say 15 per cent. is enough; and others go down to 10 per cent. Granting, for the sake of argument, that the 17½ per cent. is entirely unsupportable, where are we to get a factor that can be so supported? In these days of capital invested at 4 per cent. or so, it is easy to construct a plausible argument in favour of bringing the interest allowable on tenant's capital down to 5 per cent. So with regard to the remuneration for personal services, which, together with the interest, forms the trade profit. The difficulty is that, when the valuation is conducted on strict *de facto* terms throughout, the final result is absurd, in the light of the definitions which are contained in the Act.

The fact that the corrections are subject to the same objection as the alleged errors that they are supposed to set right, was strikingly exemplified in the recent appeal case of The Gaslight and Coke Company, which has occupied a full bench of magistrates and an army of barristers, counsel, expert valuers, engineers, &c., for some 21 days. The valuations put in on behalf of the Company agreed fairly well together; but a large number were submitted on behalf of the Assessment Committees, which differed so greatly as to excite special comment from the Bench. Speaking roughly, the lowest figure was about £600,000, and the highest close on a million sterling. With so much difference of opinion amongst presumably the best authorities, it is hard to see how it is possible, without accepting existing methods in their entirety, to arrive at a satisfactory valuation according to the terms of the Act. The dividends paid by The Gaslight and Coke Company are about £1,050,000 per annum; so the highest result just instanced assumes that the hypothetical tenant would be satisfied to accept about 1 per cent. of the total capital, or considerably under 10 per cent. on his money actually invested for the purposes of the lease, in full satisfaction of all claims as to profit. No practical man would think of leasing a gas-works for a consideration of 1 per cent. on the capital, or even for 2 per cent. And therefore I say that such valuations are absurd, according to the fair interpretation of the law.

Looking at the matter from the gas consumer's point of view, it is difficult to see the connection between some of the arguments advanced in favour of increasing the rateable value of the gas undertaking, and the actual fact that he is to be mulcted to the extent of another penny or so per 1000 cubic feet by the medium of such increase. Only a year or two ago, a great deal was said about the Coal Dues in the City of London, and the injustice of applying indirect taxation for the relief of the rates. But a large increase in the assessment of gas-works, at a time when profits are less instead of more than the legal percentage, savours very much of the same thing. Gas is in no sense a luxury, but more like a necessity of modern life; and therefore it cannot be classed with superfluities such as champagne, or silver plate, or private broughams. Large quantities of gas are used by comparatively poor persons, as an indispensable auxiliary in gaining a living; and every additional penny per 1000 cubic feet is a real burden, and not a fancied grievance. The smoke nuisance in our large towns has directed attention to the advisibility of extending the use of gas as a fuel; and if this is to obtain to any great extent, gas companies must be assisted in their endeavours to supply cheap gas rather than handicapped by the infliction of increased assessments.

The customary methods of preparing a gas-works valuation must stand or fall as a whole. It is for those who are dissatisfied with them to suggest a fairer or more direct plan; but no permanent settlement is likely to result from endeavours to strain them, to suit imaginary altered conditions. I say imaginary, because if the safety of the gas industry is more established than it was twenty years ago, the addition of 6 per cent. capital and new shares issued under the auction clauses, has lowered the average rates of profit; and it can scarcely be contended that the shareholders are better off when they are receiving an average of 6 per cent. on their investments, than they used to be when they were getting 8 or 9 per cent. Gas companies would not object to any more definite or direct method, dealing more closely with actual facts, and leaving less room for difference of professional opinion; but they naturally feel aggrieved at

* See Vol. LVI., pp. 444, *et seq.*

endeavours to strain the established practice, with the object of raising the assessment. The arrangements for hearing appeals are unfair to them, inasmuch as a value is decided upon and announced, without any details as to the facts upon which such valuation is based. So that if they are raised as much as 20 to 30 per cent., they may be left quite in the dark as to the reasons for such increase. Englishmen have a strong prejudice in favour of knowing what they pay for. If the income-tax were raised a penny in the pound without a reason being given, there would be a great outcry; yet the local tax on gas may be raised to the extent of 6d. or 1s. in the pound, and no one can tell why.

In small towns, the Union represented by the Assessment Committee may cover a large tract of country, of which the district supplied by the gas company is a comparatively limited area. Under such circumstances, the company have to contend with an opposition majority, whose interests are opposed to theirs. The town may be represented by one or two members only, whose views are outvoted by the preponderance of farmers, country gentlemen, and other representatives of the landed interests, who avowedly seek to put as much assessable value on the town as possible, with a view of keeping down the poundage. Every possible excuse is made for an attack on the gas company; and in case of an appeal, the case comes before the Recorder at Quarter Sessions. This gentleman is usually a member of the legal profession practising in the district, or a county magistrate, or otherwise intimately associated with the landed interests. He has a close acquaintance with the troubles of agriculturists on the one hand, and no special knowledge on the subject of gas supply on the other. It follows that considerations, such as the fact that the gas company have a guaranteed rate of profit and freedom from competition, are likely to weigh heavily with him. The case from the gas consumers' point of view is not represented at all. Under such circumstances, is it remarkable that complaints of excessive assessments are by no means infrequent? And there is the more reason why, if the valuation made by the gas company is rejected, the items that are not accepted should be plainly stated in the judgment, so as to give the appellants an opportunity of carrying the matter further. If the gas company consider they can show just cause of complaint, the matter might be settled by an Arbitration Committee, appointed by the Boardof Trade. The decisions of such a Committee on, say, half-a-dozen cases, would establish rules of precedent by means of which disputes would frequently be settled both promptly and cheaply.

Iron and Steel Production in the United States.—A census bulletin, relating to the manufacture of iron and steel in the New England States, has lately been published. It shows that, although a decrease (due principally to local causes affecting the supply of raw materials) has taken place in the number of establishments engaged in the manufacture of iron and steel in 1890 as compared with 1880, there has been an increase in the value of finished products. In 1870 there were 48 iron and steel establishments in New England, with an invested capital of $5,909,000, employing 3815 hands, to whom $2,168,719 in wages were paid, using materials of the value of $7,338,150, and producing manufactures valued at $10,824,603. In 1880 the number of establishments had increased to 61, with an invested capital of $11,560,408; the workmen numbering 8654, and receiving wages amounting to $3,357,911. The cost of materials was $9,518,570, and the value of products amounting to $14,558,627. In 1890 the figures afford a striking illustration of the tendency—very marked in certain trades—towards concentration in the hands of a few great capitalists. The number of establishments had decreased to 35; but the total capital invested had increased to $13,415,450. The hands employed, excluding officers and clerks, numbered 6645, receiving wages amounting to $3,224,318. The cost of materials consumed was $9,286,050, and the value of the products was $15,105,441.

Production of Cast-Iron Pipes in the United States.—As illustrating the extreme minuteness with which the industrial statistics of the United States were collected during the last census, attention may, says *The Times*, be called to a bulletin just issued relating to the manufacture of cast-iron pipes in the United States. This is the first publication of the statistics of cast-iron pipe works separate from the operations of the general foundries of the country. The bulletin shows that during the census year 1890, 36 establishments reported the manufacture of cast-iron pipes as a leading speciality of their business. The total capital invested in these works was $14,300,933, which included $68,500 reported by two establishments not in operation during the census year. The hands employed, including officers and clerks, numbered 7788, to whom a sum of $3,794,407 in wages was paid. The total cost of materials consumed was $9,483,389; and the value of the products was $15,168,682. The principal material consumed by the pipe foundries was pig iron, the quantity used amounting to 591,258 net tons, costing $7,860,408; while cast-iron pipe formed the principal product—the output being 513,030 tons of 2000 lbs., valued at $12,556,315. The pipe foundries in operation in 1880 were tabulated with other foundries of the country; so that no data are available for comparison. There has, however, the report says, been a considerable growth in this industry in the past decade, especially in the south and west. The returns for 1890 show that 20 of the establishments reporting had been built since the census of 1880.

TECHNICAL RECORD.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

The Thirtieth Half-Yearly Meeting of this Association was held last Saturday, at the Offices of the Newcastle and Gateshead Gas Company, under the presidency of Mr. R. Wallis, J.P., Chairman of the South Shields Gas Company. There was a numerous attendance of members.

Introductory Remarks by the President.

The President said his duty on this occasion was much lighter than it was six months ago. It was a most gratifying sight he saw before him—such a body of intelligent gentlemen met in the great interest of coal gas. There was no better sign of the prosperity of an Association like theirs than to see the members take such an interest as to present themselves at the meetings. The gas interest had certainly before it this year the prospect of doing very great things, of being able to pay their dividends, and of having something left over; but the unfortunate strike of the Durham pitmen had cast a gloom over their hopes. Yet he thought that they were strong enough to be able to tide over the difficulty, and that, at the end of the year, they would come out creditably. Every year, when a body of gentlemen like this met, there was always something to rejoice and something to lament about. That day, they would have, he hoped, a large accession of new members. They had also to deeply deplore the death of one who took a great interest in the Association, and who, young as he was, had made his name in the profession. He would not say much on the subject, because he perceived that his father was present, for whom he had the highest respect, and with whom he had been intimate for many years; and he would not like to harrow his feelings by making any further allusion to it. He must, however, ask the members to pass a vote of sympathy with the father of that excellent, honourable, and intelligent young member of the Association who had gone from among them this year. He certainly had given promise of rising to a very high position. They all knew he was alluding to his worthy friend Mr. Cox, of Sunderland. With respect to the strike of the Durham miners, he thought they should not take a gloomy prospect of that matter. Most of the Gas Companies in that part of the kingdom had made their contracts fairly well, and would have come out all right if it had not been for the strike. They would, however, get over the difficulty; but they must remember that the price of coal affected gas much more than anything else he knew of. They were all aware that the gas industry had been one of the most successful in the kingdom. Gas companies had gone on doubling their business every ten years—at all events, he knew one which had trebled itself in that time. Whether or not they would continue to advance with this rapidity, was a question. There was no doubt they had rivals; and those rivals were making their way, and becoming greater favourites with the public. Even, however, if gas companies did not increase in the same proportion as they had done, they would always hold their own. It would be useless for him to go over all the advantages gas companies had in their residuals; and the wonderful alterations that had been made in the chemical side of their profession. He need only look before him to see that the gas industry had called into existence a body equal to any for their scientific and their artistic attainments, as the managers and proprietors of gas-works were.

New Members and Associate.

The following new members were unanimously elected: Mr. C. Dru Drury, Superintendent of the Hendon Gas-Works, Sunderland; Mr. J. Grant, Superintendent of the Ayres' Quay Gas-Works, Sunderland; Mr. G. Airth, Assistant-Manager, Morpeth; Mr. A. B. Walker, Gas Manager, Berwick; Mr. R. Watson, Gas Manager, Newbiggin. Mr. H. J. Davis, of London, was elected as an Associate.

Notes on Tank Construction.

Mr. V. Wyatt (London) read some notes on tank construction, in which he described the construction of a tank for a 3-million cubic feet gasholder at the Redheugh Gas-Works, Gateshead. The work was done according to the plan advocated by him in a paper which he read before the Association in April, 1889—viz., by building in sections. Mr. Wyatt claimed several advantages for this method of construction, as compared with the customary method of digging a continuous trench, which required to be timbered. He read the paper to show, he said, that when he talked about doing a thing, he could also do it. This method, he further remarked, had been spoken of as an abortion; but if it was one, it had been imitated, though only partially.

Anomalies in Gas Undertakings.

Mr. Wyatt then read a paper on "Anomalies in Gas Undertakings," of which we are only able this week to give a summary. Beginning with the recommendation given by Confucius to one of his followers to let reciprocity be the rule of his conduct, Mr. Wyatt went on to say that there ought to be a mutual interchange, or reciprocity, of interests between the producer and consumer. Gas undertakings, of course, must pay a reasonable dividend to the shareholders; but the consumer should be respectfully and even tenderly treated, and supplied with the

best article for his money. All monopolies should be merciful, and should be able to do their business cheaper and better than the private trader. The country had a mortal antipathy to perpetual monopolies. It was not quite wise to incense gas consumers too much, as in some recent cases, where gas companies, with ample revenues for paying dividends of 7 to 8 per cent., and with a falling market in coal prices approaching 20 per cent., had suddenly raised their charges for gas 12½ per cent. to keep up high dividends. The power of charging under the sliding scale was delightfully simple; but the system would have to be either "mended or ended," because, in its present form, it was very confusing to the consumer. He suggested, as a standard rate upon which to start the sliding scale, 2d. per 1000 cubic feet for every ton of coal delivered in the retort-house. Corporations, who had no sliding scales, did not irritate their customers by making the price of gas jump up and down. In the near future they would have the pull over companies, in being able to wipe out all their old overcharged accounts. Then would come the tug of war, and a *régime* under which the company undertakings, capitalized up to the hilt, would have their work cut out for them. The capital accounts of the companies should be consolidated (say) into a 5 per cent. stock, and then gradually reduced, half year by half year, by means of a sinking fund, so as to make the capital correspond to the structural value of the works. The nominal capital of an undertaking should be its real capital. It was not desirable to reduce the capital below the structural value of the works and plant, as consumers of gas should pay for its true cost, including interest upon capital. The amalgamation of gas companies into grouped concerns in well-defined districts, would be a rare success, and would conduce to good management and economy of working. He advocated that a gas undertaking should perform the whole work of the distribution of gas up to the point of consumption, and that the finishing touch of gas distribution should not be handed over to plumbers. The present method of assessment of gas-works was denounced by Mr. Wyatt as most objectionable; and he suggested, in its stead, that the structural works could only be dealt with for rating purposes—business profits of an owner of property being specially taxed under the Income-Tax Acts. Perhaps there was no better way of arriving at the structural value of a gas-works than to estimate it from the number of tons of coal carbonized per annum, multiplying that number by £4 for large, and by £5 for small works. The gross rental might be deducted from that sum by taking the amount of interest payable upon it, and deducting one-sixth from it. The standards of light for testing the illuminating power of coal gas were, he said, in an unsettled condition. It might be asked why they should not abolish the candle, and have a lamp which would consume a certain quantity of sperm per hour? He apprehended they could soon devise a just standard of light for photometric purposes, if only the demon of vested interests could be snuffed out.

The Action of the Sliding Scale.

Mr. W. J. Warner (South Shields) then read a paper on the above subject; and it appears on p. 799.

Mr. Wyatt's and Mr. Warner's papers were discussed together; and at the close, a vote of thanks was passed to these gentlemen for their instructive contributions.

Election of Office-Bearers.

The President intimated that, in terms of the Scrutineers' report, the following gentlemen had been unanimously elected to office:—

President—Mr. J. Whyte, of Seaham Harbour.
Vice-President—Mr. D. Terrace, of Middlesbrough.
Auditor—Mr. J. H. Penney, of South Shields.
Secretary—Mr. W. Hardie, of Newcastle.
Committee—Messrs. William Hardie, jun., of Tynemouth; H. Tobey, of Malton; R. Moodie, of Redheugh, Newcastle; and W. J. Warner, of South Shields.

Votes of Thanks.

Mr. Wyatt said they had been presided over during the past year with great ability by their respected friend Mr. Wallis. They liked a Chairman who had a certain fund of experience. He was sure that Mr. Wallis had satisfied them all with the way he had performed his duty; and he proposed that they should accord him their very best thanks.

Mr. J. H. Cox (Sunderland) seconded the motion.

The President, in returning thanks for Mr. Wyatt's resolution, expressed the pleasure he had had in presiding over such an Association as theirs. The gas interest had always been a pleasure to him. In his younger days, when he professed a little more acquaintance with science than he had now, he always took a warm interest in the manufacture of coal gas. He made it a kind of relaxation from his more arduous and professional duties; and the members had, at a late period of his life, conferred an honour upon him which was exceedingly gratifying. He felt it most deeply; and he thanked them all for the courtesy and kindness he had received from them.

Place of Next Meeting.

It was resolved that the next meeting should be held at Seaham Harbour.

Mr. Whyte thanked the members for the high honour they had conferred upon him in electing him to the office of President. He said he felt they had made a great mistake; but he would do the best he could.

This concluded the business before the meeting.

The members afterwards dined together in the County Hotel—Mr. Wallis again presiding. The toast of "The North of England Gas Managers' Association" was proposed by Mr. R. Mitchell, Engineer of the Edinburgh Gas-Works, who, on his way home from London, broke his journey in order that he might spend an hour with his friends in the North of England. The Chairman felicitously acknowledged the toast. The proceedings, which had been of the most pleasant nature throughout the day, terminated early.

THE LUMINOSITY OF COAL-GAS FLAMES.

A Paper read by Vivian B. Lewes, F.I.C., F.C.S., before the Chemical Society, and Reprinted from the Society's "Journal."

In the autumn of 1890, I gave a course of Cantor Lectures on "Gaseous Illuminants,"* and in connection with these made a considerable number of experiments on the causes of luminosity in flames. Since then I have, from time to time, worked at the subject; and in view of the interest created by Professor Smithells' paper, read before this Society in December [*ante*, p. 68], I venture to bring my results before you. I do not propose to enter into the vexed question of how far carbon particles are essential for luminosity, or under what conditions flames containing dense vapours may become luminous, but will restrict myself to the causes of luminosity in the flame of ordinary coal gas and similar mixtures of gaseous hydrocarbons with combustible diluents.

The researches of Heumann, Soret, Burch, and the recent observations by Professor Stokes, place beyond question the presence of solid particles in a luminous gas, oil, or candle flame; and the only point on which any doubt still lingers is the kind of decomposition which leads to the liberation of the solid carbon particles. Many attempts have been made to trace the chemical changes taking place within a flame, by withdrawing the flame gases during combustion, and determining their composition; and analyses made by Landolt (*Ann. Phys. Chem.*, 1856, XCIX., 389-417) give a great deal of information about the actions taking place.

I have also made analyses of flame gases in order to trace the variations in quantity of the hydrogen, hydrocarbons, and carbon monoxide present in the centre of the flame at various heights, with the following results:—

	Hydrogen.	Hydrocarbons. Unsaturated.	Hydrocarbons. Saturated.	Carbon Monoxide.
Gas in tube . . .	57·08	4·38	33·99	2·63
½ inch above burner	52·90	4·00	32·00	3·00
1½ inches „	12·30	1·53	10·20	3·26
Tip of inner cone .	2·35	1·98	7·80	6·32
Centre of outer cone.	0·13	0·45	0·50	1·51
Escaping unburnt from tip of flame .	nil	nil	0·39	1·18

These figures, as well as those obtained by Landolt, point to the fact that the hydrogen in the gas burns first, and that the saturated hydrocarbons also undergo a rapid diminution in quantity, while the unsaturated hydrocarbons only diminish very slowly until the top of the inner non-luminous zone has been reached, after which they quickly disappear in the luminous portion of the flame. Carbon monoxide, however, increases largely in quantity up to the top of the inner cone, and then rapidly burns away in the luminous zone. This increase of the carbon monoxide during the first part of the combustion has been shown to take place in the Bunsen flame by Dr. Blochmann (*Annalen*, CLXVIII., 295), and has also been observed by Professor Smithells under the conditions existing in his beautiful experiment of burning a flame in two parts.

The fact that the unsaturated hydrocarbons only slowly decrease in the inner zone, and then rapidly disappear in the luminous part of the flame, has naturally suggested the idea that it is to these compounds that the flame owes its luminosity; but, as far as I know, no one has attempted to ascertain whether the unsaturated hydrocarbons present at the top of the inner non-luminous zone are of the same character as those found in the coal gas. The undoubted presence of acetylene in the products escaping from a cooled flame, and the fact that the incomplete combustion of hydrocarbon gases always gives rise to the formation of this compound, suggested the idea that it might play an important part in the changes taking place in the interior of a flame; and experiments were made to ascertain if any appreciable quantity was formed by the destruction of hydrocarbons in the flame gases. The coal gas used was that supplied by the South Metropolitan Gas Company; and analyses give as its composition:—

Hydrogen	57·08
Unsaturated hydrocarbons (containing acetylene, 0·035)	4·38
Saturated hydrocarbons	33·99
Carbon monoxide	2·63
Carbon dioxide	0·79
Nitrogen	0·96
Oxygen	0·15
Bisulphide of carbon	0·02
	100·00

* See Journal, Vol. LVI., pp. 1140, 1194, 1240, 1288, 1334.

And this gas, when burnt in a standard London Argand at the rate of 5 cubic feet per hour, is of an illuminating value which averages 16·3-candle power.

The gas was burned at the end of an open tube; and the flame gases were aspirated from the centre of the flame by means of a small platinum tube 2 mm. in diameter, and were led into a glass bulb-tube, in which the sample for analysis of the total hydrocarbons was collected, and then through two Volhard's absorbing bottles, containing 20 c.c. of concentrated ammoniacal silver nitrate solution. This absorbs the acetylene with formation and precipitation of silver acetylide and silver, owing to the reducing action of the carbon monoxide—two absorbing vessels being quite sufficient to prevent any traces of the gas escaping absorption. The contents of the two bottles were filtered, the precipitate of silver acetylide was carefully washed with water, and then treated on the filter very cautiously with dilute hydrochloric acid, until all action ceased. Acetylene is given off, and the precipitate then consists of a mixture of silver chloride and metallic silver. This, after washing, is digested with dilute ammonia; and the ammoniacal solution, after filtration, is then treated with nitric acid to precipitate the chloride, which is weighed in the usual manner—1 gramme of silver chloride corresponding to 0·09 gramme or 87·03 c.c. of acetylene (Winkler).

Acetylene Formed during the Incomplete Combustion taking place in the Interior of a Luminous Flame.

	Total Unsaturated Hydrocarbons. Per Cent.		Acetylene. Per Cent.
Gas in burner	4·38	..	0·035
½ inch above rim of burner	4·00	..	0·340
1½ inches „ „	1·53	..	0·560
Tip of inner cone	1·98	..	1·410
Centre of luminous zone	0·45	..	0·045
Tip of luminous zone	nil	..	nil

These figures show that, in the interior of the luminous flame, the hydrocarbons at once begin to undergo decomposition, giving rise to acetylene, which, by the time the top of the inner non-luminous zone is reached, constitute over 70 per cent. of the unsaturated hydrocarbons present. A small proportion of the other hydrocarbons, however, remains undecomposed, and penetrates into the luminous zone, where it and the acetylene are both decomposed by the higher temperature attained; a carbon is liberated, and this, being for a moment heated to incandescence, gives luminosity to the flame.

An ordinary flat flame was now experimented with, the gases being withdrawn and analyzed in the same way as before.

Acetylene Formed in the Inner Zone of a Flat Flame from a No. 7 Bray Burner.

Portion of Flame.	Total Unsaturated Hydrocarbons. Per Cent.		Acetylene. Per Cent.	Other Unsaturated Hydrocarbons. Per Cent.
½ inch from top of burner	3·565	..	0·115	.. 3·450
1½ inches from burner	2·063	..	1·303	.. 0·760
1¾ „ „	1·393	..	1·133	.. 0·260
2½ „ „	trace	..	trace	.. —

The results show that, by the time the top of the non-luminous portion of the flame was reached, over 81 per cent. of the hydrocarbons present had been converted into acetylene.

The next step was to determine the thermal conditions existing in the flat flame, in order to see if they would give any definite information as to the actions taking place.

The beautiful platinum and platinum-rhodium thermo-couple devised by Le Chatelier, and introduced to us by Professor Roberts-Austen, gives a means of measuring the temperatures of flames with ease and comparative accuracy. I made a small thermo-couple of platinum and 10 per cent. rhodium-platinum wire, using it as thin as possible to reduce errors from loss of heat by conduction, and keeping the wires of considerable length to prevent any rise of temperature introducing conflicting currents at the connections with the galvanometer wires. A reflecting galvanometer of low resistance was employed, and sufficient resistance introduced into the circuit to keep the spot of light upon the scale at the highest temperature attained in the flame; and the scale was then graduated for temperature by taking water at 0° and 100°, and checking the higher temperatures by the fusing-points of the chlorides of the alkalies and alkaline earths, as determined by Carnelley (*Jour. Chem. Soc.*, 1876, I., 489).

On mapping out the temperatures existing in a flat flame from a Bray burner consuming 7 cubic feet of gas per hour, it was found that, in the inner non-luminous portion, the temperature steadily increased from 500° half an inch from the burner, to 1267° at the commencement of luminosity at the apex; while the centre had a temperature of 1014°, rising to 1216° at the luminous edges. In the centre of the luminous portion of the flame, the temperature was 1166°; while the highest temperature was reached at the top of the flame, which gave 1368°.

These results, I think, help to explain the action taking place in the flame. In the inner non-luminous zone, the hydrocarbons heated up by the combustion of the hydrogen and some of the methane undergo certain changes, which result in their conversion into acetylene; and this, being an endothermic compound, readily decomposable by heat or detonation into carbon and hydrogen, breaks up when a sufficient temperature is attained. Owing, however, to the diluting action of the nitrogen and other flame gases, this does not take place until the top of the non-luminous zone is reached, where, at a temperature of a little over 1000°, the decomposition occurs with an increase of temperature; and the liberated carbon, being heated to incandescence, gives the luminosity to the flame.

Other luminous hydrocarbon flames were then tried; and the percentage of acetylene formed in the inner zone determined.

	Oil Gas of 30-Candle Power.		Paraffin Lamp.		Candle.
Acetylene	3·09 per cent.	..	2·222 per cent.	..	2·163 per cent.

I have made attempts to trace the actions which give rise to the acetylene, and to see if the carbon monoxide, which increases so rapidly in quantity in the inner flame, is due to the same actions, or is formed in some other way. If it be heat alone which converts the hydrocarbons present into acetylene, then this result should be obtained by passing them alone, or diluted with hydrogen, through a very narrow tube, heated to the same temperature as that existing near the top of the dark zone of a luminous flame—that is, to a little way over 1000°.

The difficulty at once arises of obtaining a tube sufficiently narrow in bore to ensure the gas being heated to nearly the same temperature as the walls of the tube without using platinum, as all attempts to obtain a nickle or iron tube of the desired dimensions failed; and the use of platinum is open to the objection of the actions induced by its surface at the temperature employed.

In order to see if surface action would in any way affect the amount of acetylene formed, a very fine platinum tube and a pipe-stem glazed with borax were heated in the same furnace to the same temperature, and an equal amount of ethylene was passed slowly through both, and the acetylene formed estimated. The acetylene formed with the platinum tube = 0·494 per cent.; that formed with the glazed pipe-stem = 0·432 per cent. On now heating the pipe-stem to a higher temperature, the acetylene formed from the same quantity of gas was 0·808; so that the smaller amount obtained in the previous experiment with the pipe-stem was evidently due to the thick clay walls.

From this it appeared as if the platinum exercised no influence on the production of acetylene in the experiment; but as I also wanted to determine the action of small quantities of air upon the hydrocarbons, under the influence of the temperature existing in the inner zone of a flame, I made a second experiment, in which methane, free from unsaturated hydrocarbons, was passed with 10 per cent. of air through a pipe-stem, and through the platinum tube, both being heated to the same temperature, which was a little under 1000°:—

Gases after Heating.

	Pipe-Stem.		Platinum Tube.
Unsaturated hydrocarbons	1·92	..	1·52
Carbon monoxide	2·30	..	2·10
Carbon dioxide	1·01	..	0·51
Oxygen	0·54	..	0·51
Acetylene	trace	..	trace

With the pipe-stem it was almost impossible to get an even temperature much above that used in this experiment; but on passing the same mixture of methane and 10 per cent. of air through the platinum tube heated to about 1100° to 1200°, acetylene appeared in quantity:—

Unsaturated hydrocarbons	3·10
Acetylene	2·07

These experiments pointed to the platinum tube having so little action on the gases as to render its use admissible in the following experiments; and the difficulties arising from the pipe-stems not being straight, from the thick walls rendering it nearly impossible to attain even heating, and from constant fracture, were so great that I decided to use a platinum tube 2 mm. in diameter and 1 foot long for the following experiments.

Methane was prepared by the action of the copper-zinc couple upon a mixture of methyl iodide and methyl alcohol, with the usual precautions, and was then passed through the tube, 6 inches of which were heated to 1000° in the flat flame of a broad Bunsen. The methane employed contained 99 per cent. of saturated hydrocarbons and was analyzed for other constituents before and after heating:—

	Before Heating.		After Heating.
Unsaturated hydrocarbons	0·50	..	3·200
Acetylene	—	..	1·798
Carbon dioxide	—	..	—
Carbon monoxide	—	..	—

The effect of heating the methane with other gases present in the inner zone of the flame was then tried.

	Methane Heated with							
	3 p. c. Oxygen.		15 p. c. Air.		50 p. c. Carb. Mon.		60 p. c. Hydrogen.	
Unsaturated hydrocarbons	2·000	..	2·000	..	1·000	..	1·470	
Acetylene	1·426	..	0·656	..	0·887	..	0·473	
Carbon monoxide	1·100	..	1·000	..	—	..	0·490	

These experiments seem to point to acetylene being formed by the action of heat alone upon the methane; but as soon as oxygen is present, carbon monoxide is also produced. The experiment with oxygen and air also shows the retarding effect of dilution upon the formation of the acetylene.

The presence of carbon monoxide in the methane diluted with hydrogen was probably caused by the latter gas containing nearly 2 per cent. of oxygen; while I think the experiment with carbon monoxide shows that interactions between it and methane cannot give rise to acetylene, as the amount formed

is just one-half that produced on heating methane alone—the reduction in quantity being due to dilution. The action taking place is most probably a splitting up of the methane into acetylene and hydrogen—

$$2CH_4 = C_2H_2 + 3H_2;$$

and some of the acetylene is then polymerized into benzene, as noticed by Berthelot (*Comptes Rendus*, LIV., 515). The methane takes a far higher temperature for the formation of acetylene than any of the other hydrocarbons experimented with.

Ethane was prepared from ethyl iodide by the action of the copper-zinc couple, and contained 93 per cent. of saturated, and no unsaturated hydrocarbons or acetylene. It, however, contained a trace of air, which would render estimation of carbon monoxide, after heating, useless.

Ethane Heated Alone.

Unsaturated hydrocarbons	19·470
Containing acetylene	8·224

Ethane Diluted with 80 per cent. of Hydrogen.

	Heated with Air to the extent of		
	15 p. c.	20 p. c.	25 p. c.
Unsaturated hydrocarbons	7·69	5·58	5·05
Acetylene	3·89	3·20	3·11
Carbon dioxide	—	1·01	1·51
Carbon monoxide	1·54	2·53	3·03

Showing that carbon monoxide is being formed in increasing quantities with the increase in the percentage of air, and that the amount of unsaturated hydrocarbons, other than the acetylene, are reduced in quantity more quickly than the acetylene itself; this, however, being probably due to their splitting up, with formation of acetylene, and both slowly being oxidized. These experiments show that, when between 15 and 20 per cent. of air is present, carbon dioxide as well as monoxide begins to form.

Ethylene was prepared by the action of sulphuric acid upon alcohol, and contained 93 per cent. of unsaturated hydrocarbons, and neither carbon monoxide nor acetylene.

	Gas Heated alone.	With 3 per Cent. Oxygen.
Acetylene	8·894	7·165
Carbon monoxide	—	5·74

Ethylene Diluted with Hydrogen.

	Gas Used.	Heated with 20 p. c. Air.	Heated with 25 p. c. Air.
Unsaturated hydrocarbons	14·50	6·81	3·66
Acetylene	—	2·03	1·59
Carbon monoxide	—	5·30	3·73

These experiments, I think, show that dilution has a distinct effect in preventing the "over-cracking" of the hydrocarbons, as the proportion of acetylene to unsaturated hydrocarbons is far higher in the gas diluted with hydrogen than in the rich gas.

In another experiment, hydrogen was charged with 1·02 per cent. of benzene vapour, and heated with varying proportions of air, with the following results:—

	8 p. c. Air.	13 p. c. Air.	18 p. c. Air.
Acetylene formed	0·026	0·032	0·218

It has been suggested that, if acetylene is formed simply by the action of heat, it ought to be present in quantity in coal and oil gas, which it undoubtedly is not. This, I think, is purely a question of temperature. The fire-clay gas-retort is never above an orange red, which means 800° to 900°; and the gas inside the retort probably never approaches this temperature. Again, in oil-gas making, 800° would be the outside temperature employed; while to convert any large proportion of diluted hydrocarbons into acetylene requires at least 1000°. Indeed, if diluted hydrocarbons are passed through a ½-inch tube heated to 1000°, the yield is very small, as only the thin layer in contact with the walls of the tube is raised to the required temperature; and it was for this reason that it was necessary to use so fine a tube in the preceding experiments.

In order to see how temperature affected the amount of acetylene formed during the manufacture of gas, I made separate batches of oil gas from Russian petroleum (Russian "distillate oil," sp. gr. 0·0864) in a Patterson retort.

Acetylene Formed in the Manufacture of Oil Gas.

Temperature of retort	500°	700°	800°	900°
Yield of gas per gallon (cubic feet)	12	60	72	84
Illuminating power (candles)	54·800	50·700	57·100	42·000
Unsaturated hydrocarbons (per cent.)	39·130	36·560	36·550	02·402
Acetylene	0·052	0·084	0·380	0·460

Showing that the quantity of acetylene steadily increases with rise of temperature.

The analyses of flame gases made by Landolt (*Ann. Phys. Chem.*, 1856, XCIX., 389-417), Blochmann (*Annalen*, CLXVIII., 295), and myself, all point to the hydrogen present in the gas burning first; and there is no doubt that the water vapour so formed and superheated in its passage up the flame interacts with the hydrocarbons, giving hydrogen and carbon monoxide, while in the luminous zone the action of water vapour and carbon dioxide upon the incandescent carbon particles again gives rise to the same products, so that their production in reality never ceases until the outer non-luminous zone of the flame is reached. In this zone it has always been supposed that the presence of a free supply of oxygen caused complete combustion, and that, with a properly constructed burner, only carbon dioxide and water vapour escaped into the air.

Delicate analyses made and described by me in the *Journal of the Society of Chemical Industry*,* show that this is not the case. Heumann noticed that, if a luminous flame was made to spread itself out over a cold surface, luminosity was destroyed, but could be restored by heating the substance over which the flame was playing. This reduction of luminosity is produced by withdrawal of heat from the flame—the temperature falling below the point necessary for the decomposition, or in some cases even the production of acetylene. In the outer zone of the flame, the inrush of cold air sucked into the flame so cools it as to render it non-luminous, and finally extinguishes it; and if the air and products of combustion be collected close to the flame, but not in absolute contact with it, anywhere between 2 inches and 4½ inches above the burner, it will be found to contain small traces of carbon monoxide, acetylene, methane, and even hydrogen. At the extreme tip, however, combustion is more perfect; and only carbon monoxide and minute traces of methane are to be found escaping.

It is usual to describe the structure of flame as built up of four zones; but if any such division into parts be necessary, I think it would be better to found them upon the main reactions taking place, due to the heat generated, and to describe them as three, viz.—

(1) The inner zone, in which the temperature rises from a comparatively low point at the mouth of the burner to between 1000° and 1100° at the apex of the zone. In this portion of the flame, the constituents of the gas undergo various decompositions and interactions, which culminate in the conversion of part of the hydrocarbons into acetylene; carbon monoxide and hydrogen being also produced, and passing into the next sphere of action, together with some methane and the products of combustion.

(2) The luminous zone, in which the temperature ranges from 1100° to a little over 1300°. Here the acetylene formed in the inner zone becomes decomposed by heat, with liberation of carbon, which at the moment of separation is heated to incandescence by its own combustion, and by the combustion of carbon monoxide and hydrogen, and gives luminosity to the flame.

(3) The extreme outer zone, in which the cooling and diluting influence of the entering air renders a thin layer non-luminous, and finally extinguishes it. With an ordinary coal-gas flame, this results in the escape of traces of hydrogen, methane, acetylene, and carbon monoxide; while with a very rich gas, unconsumed carbon also escapes.

This description of a luminous flame is of necessity far from complete, as it leaves out of consideration the numerous subsidiary interactions which are taking place; but I think it gives the general outline of the main reactions.

When Knapp and others first showed that a luminous gas-flame could have its luminosity destroyed by mixing the gas before burning with inert diluents, such as nitrogen, carbon dioxide, and steam, it was recognized that the nitrogen in the air was an important factor in rendering such flames as those of the Bunsen burner non-luminous; and most valuable contributions were made to our knowledge of the subject by Landolt, Blochmann, Heumann (*Annalen*, CLXXXI.—II.) and others. But, as far as I know, no quantitative attempt has been made to arrive at an idea of the relative importance of the various factors which influence the combustion of coal gas and the light-giving value of the flame.

In these experiments, I used a Bunsen, fitted with two supply-pipes leading to the chamber at the foot of the upright tube; each pipe being connected with a small meter, which was from time to time checked with a standard meter, so that the flow of gas and air could be accurately regulated and measured. Working with this arrangement, the amount of air necessary to render the flame non-luminous was first determined. Six volumes of gas required 13·5 volumes of air. Now, 13·5 volumes of air contain roughly 2·7 volumes of oxygen, and 10·8 volumes of nitrogen. On now passing coal gas and nitrogen through the burner, at the rate of 6 volumes of coal gas to 10·8 volumes of nitrogen, a flame was obtained which had only a faintly luminous tip; while on passing coal gas as before, at the rate of 6 volumes to 2·7 volumes of oxygen, a luminous flame is produced, which flashes back unless the tube is covered with fine wire gauze. This experiment was then repeated on the photometer.

	Candle Power.
Bunsen burning gas alone (5 c. ft. per hour)	5·6
" " 5 c. ft. gas and 2·2 c. ft. oxygen	3·1
" " " " 9 c. ft. of nitrogen	Not readable.

It appears from this experiment that the amount of oxygen in the volume of air necessary to destroy luminosity does less than one-half the work. I then tried the effect of varying the amount of oxygen added, with the following results:—

	Candle Power.
5 c. ft. gas alone	= 5·6
5 " gas to 1·1 c. ft. oxygen	= 5·4
5 " " 1·5 " "	= 8·0
5 " " 2·2 " "	= 3·1
5 " " 2·5 " "	= 0·0 (a)

(a) Gauze used.

* Vol. X., p. 413; see also JOURNAL, Vol. LVII., p. 692.

It has been already shown that the amount of nitrogen present in the volume of air required to render the flame non-luminous just falls short of the quantity necessary to bring about the same effect by dilution only; and in order to determine the volume required to entirely destroy luminosity, coal gas was burnt at the rate of 6·2 cubic feet per hour, and was supplied with pure nitrogen, which had to pass at the rate of 14·2 cubic feet per hour before all luminosity disappeared, or practically the same amount of nitrogen is required as of air:—

1 vol. of gas requires 2·30 vols. of nitrogen.
1 „ „ requires 2·27 vols. of air.

This result at first sight looks as if the oxygen in the air really only acted in the same way as the nitrogen—that is, as a diluent; but if this were so, then mixtures of oxygen and nitrogen, richer in oxygen than air, should only affect the luminosity to about the same extent as air. This is not the case, as is shown by the following results:—

Volumes of Varying Mixtures of Nitrogen and Oxygen required to render 1 Vol. of Coal Gas Non-Luminous in a Bunsen Burner.

Gas.	Volume of Mixture Required.	Composition of Mixture. Nitrogen.		Oxygen	Volume of Oxygen Present in Amount Required.
1 vol. requires	2·30 of	1	to	nil	nil
1 „	„ 2·30 „	5	„	1	0·38
1 „	„ 2·27 „	4	„	1	0·45
1 „	„ 2·02 „	3	„	1	0·50
1 „	„ 1·49 „	2	„	1	0·50
1 „	„ 1·00 „	1	„	1	0·50
1 „	„ 0·50 „	nil	„	1	0·50

This set of experiments shows very beautifully that, until the percentage of oxygen reaches the amount present in the atmosphere, the diluting influence of the nitrogen is so strong that it prevents the oxygen having any practical effect in the destruction of the luminosity, but that as soon as the quantity of oxygen present has risen above 25 per cent., its activity has so far overcome the diluting influence of the nitrogen that the latter has ceased to exercise any retarding influence upon it.

In almost every laboratory it may be noticed that, whereas most of the Bunsens are burning with their normal blue, noiseless combustion, some one or two are roaring, and burning with a sharply defined green centre; and experiment shows that this is brought about by the gas-delivery jet having become partly stopped up, and a far larger supply of air than is necessary to cause non-luminosity being sucked in.

Ratio of Gas to Air in Blue and Green Non-Luminous Combustion.

Blue	1 vol. of gas to 2·27 vols. of air.
Green	1 vol. of gas to 3·37 vols. of air.

The green centre shows, therefore, that a large excess of air is passing in; and such a flame is on the point of flashing back in the burner, and lighting at the bottom. In this case, the kind of action taking place in the flame has undergone considerable alteration—the flame being fiercer and smaller than in the normal combustion; the change being due to the fact that the proportion of oxygen to coal gas in the mixture is such that the chemical activity of the oxygen is able to overcome the diluting and cooling action of the nitrogen, so that the latter has practically ceased to act.

The next step was to determine the proportions by volume of various gases required to render the Bunsen flame non-luminous; the number being limited by having to use a wet meter for their measurement.

Volumes of Gases required to render 1 Vol. of Coal Gas Non-Luminous.

1 vol. of gas requires	0·50	vol. of	oxygen
1 „ „ „	1·26	vols. of	carbon dioxide.
1 „ „ „	2·27	„	air.
1 „ „ „	2·30	„	nitrogen.
1 „ „ „	5·11	„	carbon monoxide.
1 „ „ „	12·4	„	hydrogen.

This shows that a diluent which burns and adds to the general temperature of the flame must be added in far greater quantity than an inert and non-combustible diluent such as nitrogen—a result fully borne out by experience.

Some observers have attributed the varying effect of diluents to the effect of density (D. Waldie, *Phil. Mag.*, 1838); but the destruction of luminosity in a flame can be brought about by cooling as well as by dilution, as is well shown by the experiment described by Heumann (*loc. cit.*). It is evident that, this being the case, if one diluent has the power of abstracting more heat from the flame than another, it will be more active in reducing the luminosity; and a smaller quantity will be required to render the flame non-luminous. On comparing the specific heats of equal volumes of the diluents used in the last experiment, the reason for the small quantity of carbon dioxide required is at once seen.

Specific Heats of Equal Volume.

Oxygen	0·2405
Carbon dioxide	0·3307
Nitrogen	0·2370
Air	0·2374
Carbon monoxide	0·2370
Hydrogen	0·2359

If this be the true explanation, then it should be easy to trace the action by the decrease in temperature of the flame when carbon dioxide is used to render it non-luminous.

In order to take the temperatures of the inner cone of the flame by means of the thermo-couple before described, it is manifest that the wires, even when protected by glass, must not be passed through the outer zone, as with mixtures of coal gas and air the heated platinum would set up rapid combination on its surface. To overcome this difficulty, the wires, insulated with glass, were passed up the interior of the burner-tube, and the gas supply was kept constant at 6 cubic feet per hour; the diluents being supplied under pressure at the same rates as before determined. The results in the following table were obtained:—

Temperature of Flame from Bunsen Burner, with a Consumption of 6 Cubic Feet of Coal Gas per Hour.

Point in Flame.	Flame rendered Non-Luminous by Air.	Nitrogen.	Carbon Dioxide.	Luminous Flame from Bunsen.
½ inch above burner	54°	30°	35°	135°
1½ „ „	175	111	70	421
Tip of inner cone	1090	444	393	913
Centre of outer cone	1533	999	770	1328
Tip of outer cone	1175	1151	951	728
Side of outer cone, level with tip of inner cone	1333	1236	970	1236

These results fully bear out the inferences derived from the behaviour of the flames in the former experiments. In the flames rendered non-luminous by diluents, the inner cone for the first 1½ inches is decidedly cooler than in the luminous flame, owing to the cooling action of the nitrogen or carbon dioxide; in the upper portion of the inner cone of the flame rendered non-luminous by air, however, the oxygen of the air is acting, and the temperature is therefore higher than in the luminous flame; while in both the hottest portion of the flame is almost half way between the tip of the inner and outer cones. In flames rendered non-luminous by inert diluents, this is not the case, as the full amount of air necessary for combustion only being obtained at the side and tip of the outer cone, these are the hottest points.

The low temperature registered at the tip of a luminous flame is probably due to the impossibility of keeping that portion of the flame steady when the gas is burning from a Bunsen with the air supply closed. Experiments with a Bunsen burning a mixture of air and coal gas in such proportions as to give the green inner cone showed that, although the excess of air caused a low temperature at the bottom of the inner cone, the increase in rapidity of oxidation, due to excess of oxygen, caused a rapid rise of temperature, and that a hotter and smaller flame was the result:—

	Blue Inner Cone.	Greenish Inner Cone.
Tip of inner cone	1090°	1575°
Centre of outer cone	1533	1630
Tip of outer cone	1175	1545
Side of outer cone, level with the tip of inner cone	1333	1511

These experiments, as well as the researches of Heumann, show that oxidation, dilution, and cooling all help to bring about the destruction of luminosity in a Bunsen flame.

At this point it seemed important to determine how dilution acted towards gases richer than ordinary coal gas. In order to do this, I decomposed Russian distillate oil in a Patterson retort, and made two batches of oil gas—one of 24-candle, the other of 43-candle power. These gases were then analyzed, with the following results:—

Oil Gas.

	24-Candle Power.	43-Candle Power.
Carbon dioxide	0·95	1·52
Oxygen	0·74	—
Unsaturated hydrocarbons	18·06	33·16
Saturated hydrocarbons	43·62	45·15
Carbon monoxide	0·95	0·52
Hydrogen	34·58	19·65
Nitrogen	1·12	—
	100·00	100·00

These gases were then tested in the Bunsen burner, at a carefully regulated rate of flow, with air, carbon dioxide, and nitrogen; and the following figures were given:—

Amount of Diluent required by 1 Volume of Gas to render a Bunsen Flame Non-Luminous.

Kind of Gas.	Candle Power.	Air.	Nitrogen.	Carbon Dioxide.
Coal	16·3	2·27	2·30	1·26
Oil	24·0	5·38	4·20	2·29
Oil	43·0	7·86	4·71	3·12

These figures reveal the interesting fact that, with a rich gas, far less nitrogen than air is required to bring about loss of luminosity, on account of the high temperature produced by the combustion of the heavy hydrocarbons with the oxygen in the air. The effect of the inert diluents was also noticeable, as at the point of non-luminosity the flame separated itself ¾ inch from the mouth of the burner, and became very elongated.

The question now arises as to how dilution, apart from its cooling action, reduces the luminosity. On passing 1·5 cubic feet of coal gas slowly through a platinum tube, 0·15 metre long and 12 mm. in diameter, packed with platinum foil, and heated to redness by a Bunsen burner, it deposited 0·2200 gramme of carbon. The same volume of gas was then diluted with 3·3 cubic feet of nitrogen, and the experiment repeated under exactly similar conditions, when only 0·0013 gramme of carbon was deposited—dilution reducing the amount of decom-

position to this enormous extent. A second experiment was then made, in which, by means of a blowpipe flame, a higher temperature was obtained; and 1·5 cubic feet of gas, as before, was passed through the tube, when it deposited 0·2780 gramme of carbon.

	Before Heating.		After Heating.
Carbon dioxide	0·2	..	0·8
Oxygen	0·3	..	0·2
Unsaturated hydrocarbons	4·2	..	3·0
Carbon monoxide	2·6	..	2·8

Under the same conditions, a mixture of 1·5 cubic feet of coal gas and 3·45 cubic feet of nitrogen deposited 0·0640 gramme of carbon; showing that the effect of dilution is decreased by increase of temperature.

These experiments, I think, show that, when coal gas is diluted to the degree necessary to give a non-luminous flame in the Bunsen burner, the liberation of free carbon is reduced by the retarding action of the inert gas; but as the temperature rises, this action gets less and less.

The action of diluents in increasing the temperature necessary to bring about deposition of carbon was, I believe, first noticed by Wartha, and is probably due to two distinct causes. As has already been shown, the formation of acetylene from the hydrocarbons in the gas is retarded by dilution; while if any be formed, the temperature necessary to decompose it into carbon and hydrogen is greatly increased. These two retarding influences give time for the oxygen present in the air introduced with the gas, and in the air sucked into the flame, to burn up the hydrocarbons without previous decomposition, and so prevent luminosity; and it is probable that the prevention of the formation of acetylene is the chief factor, as only the merest trace can be detected in a non-luminous Bunsen flame.

Collecting the results, we can now explain the various actions which lead to loss of luminosity as follows:—

1. The chemical activity of the oxygen introduced in the air, which causes loss of luminosity by burning up the molecules of hydrocarbons before, in their diluted condition, they can form acetylene.
2. The diluting influence of the nitrogen, which increases the temperature necessary for the formation of acetylene from the hydrocarbons; while if any be formed, a higher temperature is necessary for its decomposition. In this way diluents alone will render a flame non-luminous; and in the normal Bunsen flame nitrogen acts in this way until the hydrocarbons have been destroyed by oxidation.
3. The cooling influence of the air introduced, which is able to add to the general result, although the cooling is less than the increase in temperature brought about by more rapid oxidation.
4. In a normal Bunsen flame, the nitrogen and the oxygen are of about equal importance in bringing about non-luminosity; but if the quantity of air be increased, the oxidation becomes the principal factor, and the nitrogen practically ceases to exert any influence.

I should like to have worked out the secondary reactions taking place in a luminous flame, and so have completed this paper; but, as Professor Smithells proposes to undertake this, I leave the question in his hands, and trust that he may be successful in clearing up the many points which remain to be solved.

In conclusion, I wish to express my thanks to my assistants —Messrs. F. B. Grundy and H. S. Marsh—for the help they have given me in the work entailed in this paper.

Mr. H. Kendrick, for upwards of twelve years in the service of the Birmingham Corporation Gas Department, at the Saltley works, has been appointed Outdoor Superintendent of the Salford Corporation Gas Department, under their Engineer, Mr. S. Y. Shoubridge.

A Water-Leak Indicator.—A novel signalling apparatus is to be used in connection with the city water-works of Covington (Ky.), to give warning of leaks in the supply main or any accident along the line needing immediate attention. The water supply for Covington is pumped from the Ohio River to reservoirs, from which it passes by gravity through about eight miles of pipe to the city. As there is only a single pipe-line, it is especially necessary to detect and repair leaks as soon as possible. It is proposed to have parallel with the pipe-line a telegraph wire strung on poles. Connected with the wire will be signal-boxes located in farmhouses, and each having numbers. A card of instructions will be placed beside each box, with, for example, the following code of signals: One ring, a land slide; two rings, a small leak; three rings, a large leak; more than three rings, a serious break requiring immediate attention. The alarms will be sounded both in the city office of the works and at the pumping-station; the number of the signal station being indicated as well as the character of the trouble. In case of a serious break, says *Engineering News*, the men at the pumping-station will at once proceed to the reservoir and shut off the supply from the main; after which, of course, men would proceed to the break to make repairs.

SOME NOTES UPON THE ACTION OF THE SLIDING SCALE.

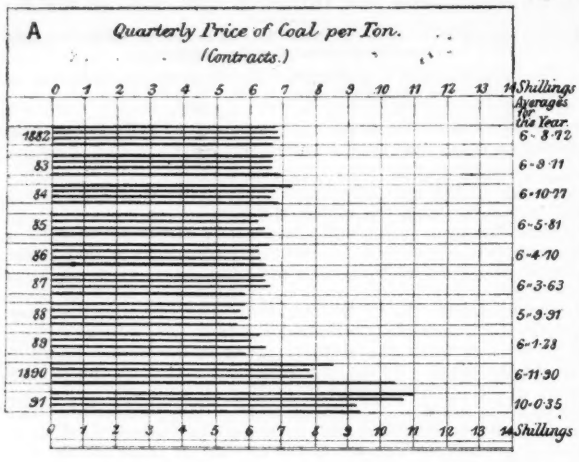
A Paper read by W. J. Warner, of South Shields, before the North of England Association of Gas Managers, April 30.

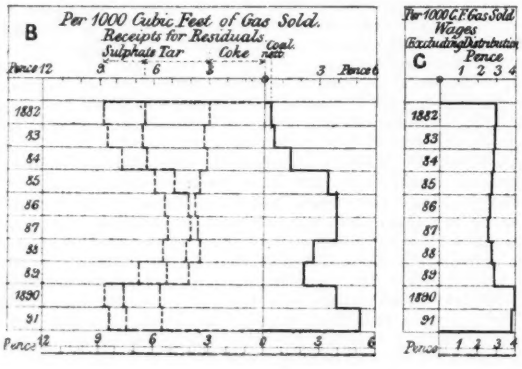
Mr. President and Gentlemen,—The remarks which I have to offer may be considered as suggested by, and supplementary to, what was said at our Tynemouth meeting. I refer to the able discussion upon the general policy to be recommended under the commercial difficulties which were then rapidly increasing upon us. I need scarcely remind this meeting that, after a very full and interesting discussion, the general opinion was not to advance the price of gas unless absolutely necessary. I did not disagree with this; but I ventured to put in a plea for the shareholders. While fully admitting the grave responsibilities of our position in dealing with our customers, I felt that there are other duties due to the undertakings with which we are identified. There are prescribed rights as well as duties; and these are not, when the sliding scale is in full action, opposed one to the other. There is a reciprocal action by the sliding scale upon price and profit; and by this the consumer and shareholder have a common interest in the prosperity of the undertaking. This, however, is not so fully recognized as it should be (not to use too harsh a term) by those whose self-imposed duties lead them to discuss such questions. Those who would disturb the machinery so well and so wisely arranged for the benefit of the consumer, the capitalist, and the public incur very great responsibilities.

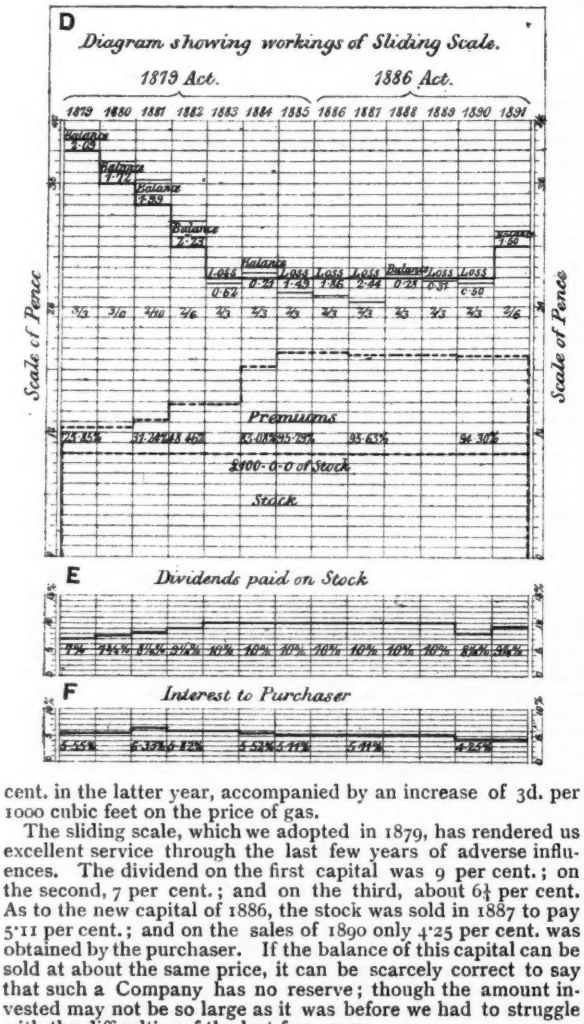
Our commercial prospects have not, unfortunately, improved since the meeting at Tynemouth. Balances to profit have been more or less exhausted, and reserve funds dipped deeply into. The price of gas has had to be advanced, and in some places again advanced. Matters thus prejudicially affecting important interests all round could not have been expected to be of the pleasantest character—could not have been expected to raise the value of stock. Yet the consumer's increase is not proportionate to the increased cost of production; and he may get some consolation from the fact that he is paying very little more for his fuel, if he uses his gas as fuel, than he did before the "holidays" and strikes of the colliers, and the shareholder may feel some satisfaction that his dividends have suffered so slightly in passing through times in which labour has exacted at once an increase of about 50 per cent., and the cost of raw material has been advanced 100 per cent. Why, then, should there be those jarring, disturbing elements occasionally to be found to lessen our influence and weaken our position? The present abnormal condition of things comes entirely from matters outside our sphere of action. The residual markets, as was recently pointed out by the JOURNAL OF GAS LIGHTING, are beyond our control; the coal market is the same; and so, it may almost be added, is labour; and it is the abnormal depression of one, and the undue increase of the others, which places us in our present position. This must be known, in a general way, to the consumer, the shareholder, and the corporation; but it should be known accurately and fully by those who attempt to deal with such matters, and draw conclusions from them for themselves, their neighbours, and the general public.

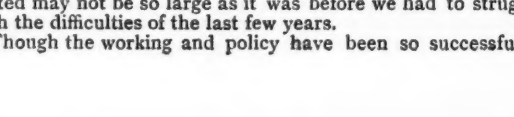
That the disturbing elements may be comparatively and relatively seen, I have prepared some diagrams [see next page]. The several matters dealt with extend over the last ten years. The cost price of coal, quarter by quarter, is shown on the diagram marked A; B gives the amount received for residuals, and shows the net cost of coal per 1000 cubic feet of gas sold; and C is the wages diagram, excluding the cost of distribution. Upon referring to diagram A, it will be seen that the price of coal ranged from 6s. to 7s. per ton during the period from 1882 to 1889, both years included. It then rose to about 10s. per ton in the last quarter of 1890; and reached 11s. in the first quarter of the following year. Now turning to B, it will be seen that while the *price* of coal may be said to have gradually receded from 1882 to 1889, the *net cost* very rapidly advanced to an increase of above 3d. per 1000 cubic feet of gas sold. Now, passing over to C, it will be found that we were slightly assisted by a gradual decrease in the cost of labour till 1888. Then, just as we were getting a little relief by the price of coal coming down and the residuals going up, labour advanced; in the following year, it did so again; and then, with a great bound, in 1890 it was increased to above 50 per cent. over 1887. Our present position, therefore, when compared with 1882, may be broadly stated thus: Residuals totally are the same; but, through the increased cost of coal and labour, the cost of gas has increased 6d. per 1000 feet, while our charge is the same.

Now turning to diagram D, we shall see the influence of these three items upon dividends. In 1882 the price was 2s. 6d. per 1000 cubic feet; and a balance having been shown of about 2½d. and the reserve fund being full, the price was reduced 3d. In the following year, there was a slight loss; but that was recovered in the succeeding year. In 1885, the next year, when the first great drop in the values of residuals was so serious, the loss shown was about 1½d. per 1000 cubic feet. This was followed in 1886 by a further decline in the value of residuals, and a further loss upon the year's working—nearly 2d.; and the next year it nearly reached 2½d. Residuals improved in 1888 and 1889. Both coal and labour went up enormously in 1890; and coal again in 1891. These effects are shown by a reduction of dividend of 1¾ per cent. in the former, and ¾ per









cent. in the latter year, accompanied by an increase of 3d. per 1000 cubic feet on the price of gas.

The sliding scale, which we adopted in 1879, has rendered us excellent service through the last few years of adverse influences. The dividend on the first capital was 9 per cent.; on the second, 7 per cent.; and on the third, about 6¼ per cent. As to the new capital of 1886, the stock was sold in 1887 to pay 5·11 per cent.; and on the sales of 1890 only 4·25 per cent. was obtained by the purchaser. If the balance of this capital can be sold at about the same price, it can be scarcely correct to say that such a Company has no reserve; though the amount invested may not be so large as it was before we had to struggle with the difficulties of the last few years.

Though the working and policy have been so successful to the undertaking, and hence to the consumer, it has been satisfactory to the investor as an investment. I will take a few typical cases, extending over the period with which we have been dealing—viz., 1882 to 1892.

No. 1 purchased to pay	£5	os.	1d.	per cent.,	but received	£5	2s.	6d.
2	,,	,,	4	18s.	10d.	,,	,,	5	0s	7d
3	,,	,,	4	16s.	2d.	,,	,,	4	17s	11d.
4	,,	,,	4	13s.	5d.	,,	,,	4	16s.	0d.
5	,,	,,	4	16s.	2d.	,,	,,	4	18s.	4d.

In every case, it will be noted, there has been a gain upon the purchase, though, through the adverse circumstances, not so large as it would otherwise have been. A reference to diagram F will show much the same figures, though the dividends on diagram E are very different. The interest to the purchaser is somewhat constant; the dividends varying with the fluctuations in the price of gas, as shown by the sliding-scale diagram D, only, of course, in the opposite direction—the dividend ascending as the price descends. The action of these upon the capital is shown by the dotted lines in D.

Thus we arrive at the real point of my paper, and its supplementary matter to our discussion at Tynemouth. It was then held—and very properly so, for the reasons given, and with our then somewhat limited experience of strikes and enormously fluctuating markets—that the charge made for gas should not be advanced till it was absolutely necessary. Such an understanding, however, leaves the matter somewhat undefined—leaves the price, as it must be, dependent upon the exigencies of the undertaking, or to some extent upon the individual judgment of those having to make the change. There is in this no standard to which to work. To some, the moment for action would be the exhaustion of the balance in the yearly accounts; to others, it might mean drawing upon the reserve fund; to others, its exhaustion; while to others, the deficiency in the year's working would have to be met at once by the alteration of price. This latter, for those who are not under the sliding scale, would mean an immediate attack upon the undertaking. By the adoption of such a course as this, the consumer, it would be said, alone suffered. With the sliding scale in action, both consumer and shareholder would be affected by change of price. But under both systems—that of a fixed dividend with a varying price, and a varying dividend with a varying price—the position of the undertaking in the Money Market would be affected by the exhaustion of the balance and reserve fund; and so would the revenue too, in cases where the funds had been full.

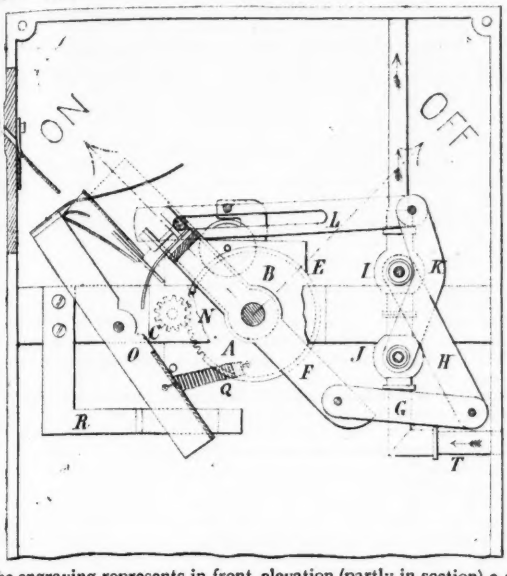
In the action of the sliding scale in its entirety—affecting the threefold interest of consumer, shareholder, and the undertaking—the latter should not, if it is possible to avoid it, be allowed to suffer; its interest should be paramount. The reserves, therefore, should be kept intact; and the chief of these is undoubtedly the premiums upon the sale of stock, which is dependent upon the dividend (and this is regulated by the price of gas), which, in turn, is affected by the premiums paid for stock. By referring to the diagrams, we see the reciprocal action of the price of gas upon dividend, and it again, in its turn, upon the price of stock; while the interest to the shareholder is almost unmoved through all the varying changes, though the value of his stock is marvellously increased through the premiums. That these premiums should be maintained, if possible, there can be no question. The reserve fund, too, when full, being a source of revenue, should also be maintained. I fully admit, however, the value of constant dividends to those who have to go frequently into the Money Market; and also that there is still a considerable amount of elasticity in gas undertakings. But with the experience of the past few years—a succession of adverse circumstances, the introduction of rival systems, strikes, high markets to buy from, and low ones to sell in—would it not be better to let the principle of the sliding scale have *full* action, and let the price of gas be regulated by its cost year by year? We used it only under flourishing circumstances till we were obliged to put its principle in force. Would it not have been wiser to have conserved our reserves? Had the succession of bad years been foreseen, I do not think the sliding scale would have been allowed to remain so long inoperative. I believe that, in the future, we shall be wiser, and allow full action to the well-devised, equitable, and delicate machinery of the sliding scale, and leave it to adjust to the cost the selling price, and to it the dividend.

North British Association of Gas Managers.—In view of the forthcoming annual meeting of this Association, which is to take place on July 28 and the following day, the Committee are making preparations for the event; and the Secretary (Mr. R. S. Carlow, of Arbroath) has issued to the members the usual preliminary circular, inviting their co-operation in making the gathering profitable as well as pleasurable, by presenting to the meeting, in the form of a paper, their views on any subject to which their attention may have been specially directed, or on any of those which are suggested in a list accompanying the circular. Mr. Carlow reminds his colleagues of the activity which characterizes the present period in the history of gas lighting. He thinks it will be readily admitted that great and important changes are imminent, not only for improving the light-giving properties of coal gas, but also for extending its uses in various ways; and he therefore, in the name of the Committee, presses the matter upon the serious consideration of the members.

REGISTER OF PATENTS.

Automatic Sale and Delivery of Gas.—Brownhill, R. W., of Aston, near Birmingham. No. 5378; March 26, 1891.

The object of this invention is the automatic sale and delivery of gas and liquids, on prepayment by coin or its equivalent, without the use of a meter or meter attachment, as is described in patents No. 7012 of 1887, No. 6537 of 1888, and No. 20,583 of 1889.



The engraving represents in front elevation (partly in section) a prepayment chronometric gas-delivery apparatus constructed and arranged according to this invention. It is intended to deliver gas in given quantities, on prepayment, by starting running-down mechanism at the time of, or subsequent to, the introduction of a coin through the coin slot so that gas can be consumed at the time it is paid for, or at any other time as may be desired. Thus, consumption is admitted by the turning on, first of the master tap, which is only done through the intervention or introduction of a coin, which places certain mechanism in positions which will run down or expend itself on consumption only. The master tap shuts off from, or allows gas to flow through, the gas pipe or inlet; whilst a supplementary or secondary tap turns on and off the gas as may be desired, without interfering with the master one. Hence there is independent action in both, although, unless the master tap is turned on, the turning on of the supplementary one will have no effect. The parts are shown in the positions they assume on the gas being both shut off and turned off.

A is a horizontal axis, working within bearings, and supported by brackets or framings, and carrying at its inner end, upon a loose sleeve, a multiplying toothed-wheel B, which gears with a pinion C, to the axis of which the inner end of a volute spring enclosed within a barrel or casing is fixedly connected. The spring has its outer end connected to a pin carried by the chronometric mechanism-carrying framing E. Made fast to the axis A is a turning-off double-armed lever F, having at its lower end a jointed link G, connected to a swinging arm H, with its upper end attached to a turning on and off tap I, and through which arm the tap is operated. The upper end of the lever F is moved from right to left for turning on, and from left to right for turning off the gas, after the master tap J has been turned on through the intervention of the link K and slotted arm L. Fitted and made fast to the extreme end of the axis A is a handle having a pointer upon the front or upon the axis of it. The upper and top end of the lever F carries a box connection with a slotted lower part, bracket, and mouth having lips or inwardly depending branches. Turning freely upon the axis A is a shutting on and off lever N, having mounted at its back, and upon the sleeve of the same, a multiplying toothed-wheel B, which gears with the pinion C as aforesaid; so that, on an angular movement being made by the lever, the toothed wheel moves with it, and independent of the turning-off lever F, other than when connection is made between the levers by or through the intervention of a coin. The lever or arm N, has forked branches at its upper end, and also a fraud-prevention lever with the inner part formed into a neck or stud, which works within the slot of the quadrant arm L, which has end abutments. O is a jointed wiper lever, having at its lower end a pallet, and with the upper end carrying a wiper (gapped about its middle), consisting of a strip of thin sheet metal made to traverse over the balance-wheel of running down and escape mechanism. Q is a coiled spring for bringing back the lever to its normal position, after being released by the spring-catch R. S is a coin-slot, with a shoot directed to the open top or mouth of a coin-box receiver. T is a pipe with the upper end leading to the gas-jets, and which gas-pipe carries chambered bosses in which the plugs I J, with gas-ways through them, are fitted.

Assuming the parts of the mechanism to be in the positions shown, and with the master tap shut off, and the supplementary tap opened, on a coin being dropped through the coin-slot S, it slides down the shoot and, dropping into the box, rests at the bottom, opposite the gapped parts and upon and between the branched parts. This coin, as introduced, makes the connection of the lever F, with the lever N, which move together as if they were rigidly connected. By now turning the handle, the axis A, levers F, N, and toothed-wheel B, and the whole of the accessory parts carried by these members, are turned from left to right. This lifts the quadrant arm L; and on the stud or neck which traverses in the slot impinging against the end abutment, the link or arm K, and with it the quadrant arm L partakes of the motion, and are hereby turned back upon the plug of the master tap J, as a centre of motion, and by such rear action of the parts, the master tap is opened. As the movement of the lever F is in the same direction as the lever N, the link G and swinging arm H, are also moved rearwardly, and the supplementary tap I is closed, by the gas-way of the plug being brought at right angles to the gas-way of the pipe T. Immediately the motion of the lever F is reversed, by the turning of the handle in a contrary direction, the lever F leaves behind the lever N, and the penny drops from between the parts into a receiver below; and by fully turning back the lever F, the swinging arm H, and the link G, are turned back, and the supplementary tap I turned on. The former forward movement of the lever F causes its lower heel part to pass over the releaser of the catch R, and impinge against the pallet of the lever O, turning it upon its centre and taking the wiper upon the periphery of the balance-wheel P, until the top of it rests within the gap of the wiper, and at the same time winds up the hair-spring of the wheel. The toothed-wheel B, by being connected with the lever N, is rotated; and through it the pinion C is turned, and the spring enclosed within a barrel is wound up. This barrel has upon its periphery, or has connected with its axis, a toothed-wheel, which gears with a pinion, and so on through the train of wheels and clock mechanism parts as shown.

As the supplementary valve is now closed, and at the same time the chronometric mechanism prevented from running down, and also the wiper lever O, held by the edge of the lower part of it coming against a shoulder, by now turning again from right to left the handle, and the lever F with it, the lower end strikes the releaser, pushes back the catch R, and releases the wiper lever O, which turns on its joint centre, and draws the wiper over and upon the top of the balance-wheel P, so as to set the same and the clock mechanism in motion; and this motion of the lever is given to it by the contraction of the coiled spring Q.

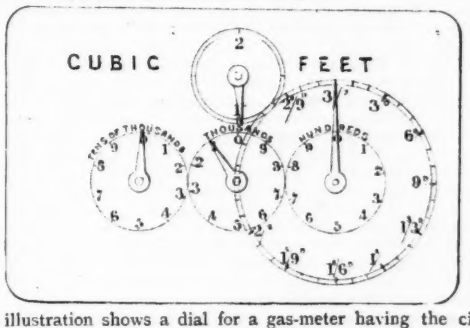
Gas now being consumed by the opening of the supplementary tap, the chronometric mechanism begins to run down; and as this continues, so the lever N, and parts carried by it, go with it, until a nick or stud impinges against the end of the slot, and the slotted arm has imparted to it a forward traverse, which turns the link K, and shuts off the master tap.

Gas or Vapour Engines.—Ridealgh, W. R., and Welford, R., of Sunderland. No. 6598; April 17, 1891.

These improvements in gas or vapour engines consist substantially in utilizing one cam for working the valve gear, having one passage to the working chamber for both the inlet and outlet, and having a momentum governor for regulating the speed—this governor acting by having momentum imparted first, the gear then acting by hitting or missing the gas-valve connection.

Indices for Gas-Meters.—Deighton, W., of Harrogate, and Wright, T., of Leeds. No. 6851; April 21, 1891.

These gas-meter indices are designed to enable both the amount of gas consumed and also the price to be seen at a glance; the registering of the quantity and of the value being effected by the same train of wheels. For this purpose, around the spindle or shaft of the pointer for registering hundreds of cubic feet, there is a large outer circle in addition to, and concentric with it; this outer circle having prices marked on it representing the value of the gas.



The illustration shows a dial for a gas-meter having the circular scales or circles representing the quantities of gas consumed arranged in the ordinary manner. Around the "hundreds" circle is a large outer circle on which, in a radial line with the O on the "hundreds" circle, is marked the price per 1000 cubic feet of the gas—in this case assumed to be 3s. The pointer is made sufficiently long to extend over both circles, which are so graduated that the value indicated by the pointer on the outer circle corresponds with the quantity on the inner circle.

The patentee also describes a form of dial for indicating the value of the gas consumed up to 10,000 cubic feet. In this case, the pointer on the spindle of the "thousands" circle is prolonged sufficiently to extend over a circle which encloses all three circles; and the price of 10,000 cubic feet—in this case supposed to be 30s.—is placed in line with the O on the circle. The outer circle is graduated from 1 up to 30—the division representing shillings, and showing the value of the amount of gas represented on the "thousand" circle. With this arrangement, the hundreds circle as described above may be combined; and thus represent the corresponding values for less than 1000 feet.

Prepayment Gas-Meters.—Cowan, W., of Edinburgh. No. 18,141; Oct. 22, 1891.

This invention, relating to prepayment gas-meters of the coin-freed type, consists of modifications of, as well as of additions to, previous inventions—No. 11,537 of 1890, and Nos. 3575 and 8444 of 1891. The present invention provides: Firstly, an improved substitute for the eccentric arrangement, consisting of a reciprocating rack arrangement; secondly, an improved operating handle, whereby the fraud known as "pumping" is prevented; thirdly, an improved price-changing adjustment, applicable to the eccentric and reciprocating rack arrangements; and fourthly, to an improved double shoot arrangement, whereby small

coins and surplus coins are returned to the consumer without operating any of the interior mechanism.

The improved substitute for the eccentric arrangement described in patent No. 8444 of 1891, consists of a reciprocating rack arrangement, illustrated in figs. 1 and 2. In it, there is mounted a circular or other rack A alongside the slot-piece B; the rack being formed with an extension at right angles to its centre line, and which acts as a pusher within the slot-piece. The rack may, however, if desired, be formed in one with, or lie in line with, the pusher. In either case it is reciprocated backwards and forwards by two spurred pinions C D, mounted one above and the other below the rack, so as to enable them to be operated in their respective directions by means of a revolving disc E, having two segments of spur teeth, operated or revolved by the consumer after the insertion of a coin in the slot through the medium of a suitable handle as heretofore. The whole of the parts are carried by brackets within the index case.

Fig. 1.

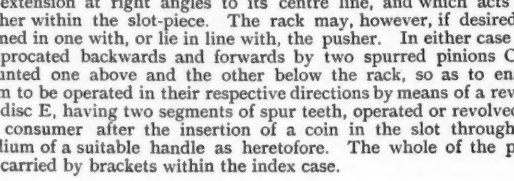


Fig. 2.

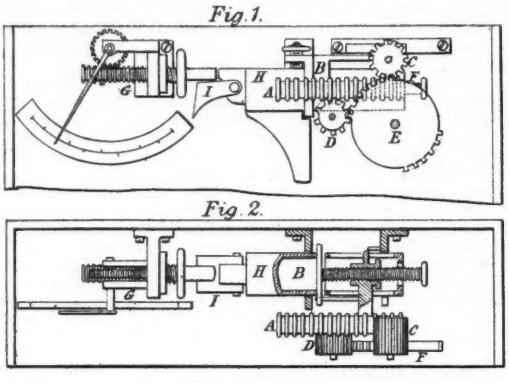
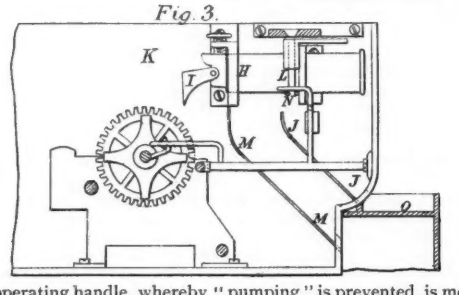


Fig. 3.



The operating handle, whereby "pumping" is prevented, is mounted loosely on the axle of the eccentric, cam-shaped lever, or revolving disc E, and is provided with a pin or projection, which works in a check or recess formed in a collar on the axle. The object of this is to allow the handle a little play, to enable the pawl to act quicker, and so prevent the handle being moved alternately backwards and forwards.

The price-changing adjustment is shown in figs. 1 and 2. The pusher-rod F is formed as a screw; and it is screwed into or out of the eccentric's projection, or the rack's projection, which now forms a carrier for the pusher or screw. The screwing of the pusher in or out of the carrier thus alters the effect it has on the prepayment mechanism, which may be set to any desired distance by means of the adjusting arrangement G or register, as described in patent No. 3575 of 1891. This consists of an adjusting screw having a rack and pinion working a pointer on a scale; the whole being mounted in front of the extension H of the slot-piece. The adjustment is applicable to both the eccentric and reciprocating rack arrangements; whereby, although the movements are in each case uniform, the movement given to the pawl I and prepayment wheel is capable of adjustment.

The double-shoot arrangement is illustrated in fig. 3. The patentee provides an extra shoot J mounted inside the index-case K in such a manner and in such a position that, when the slot of the slot-piece L is in its normal position (as shown), the coin, if present, does not stand directly over the entrance of the money-box shoot M, but over the mouth of this extra shoot, which communicates with an opening in the outside case of the meter in such a way that, on placing a small coin in the slot N, it passes through it down the shoot, and through the opening on to a platform O formed on the outside of the meter-case, and from which it may be easily recovered.

The double shoot J is also applicable for delivering back surplus coins—that is, coins which are inserted after the prepayment pointer has reached a predetermined position on the prepayment dial. The delivery of surplus coins is effected by forming the guard which retains the proper coin in the slot as a moveable guard, and connecting it by means of rods and a spindle, which is preferably centred at each end, to a tail-piece, operated at the proper time so as to remove the guard away from the slot, and so allow the surplus coins to fall down the shoot and on to the platform O by means of a cam or projection formed on, or attached to, the shaft of the gearing-wheel. The parts are retained in their normal positions, as shown, by means of a counterpoise weight until the predetermined quantity of coins has been put in, when, owing to the action of the last coin inserted, the guard has been removed, and no more will act on the mechanism, but will simply pass out on to the platform.

Coal-Conveyors.—Lewis, T., of East Boston, Mass., U.S.A. No. 21,913; Dec. 15, 1891.

This invention relates to apparatus for conveying coal from the hold of a vessel to a suitable receptacle on the shore—particularly to that class of conveyors in which the coal is lifted and removed from the vessel to the shore by buckets operated by endless chains. It is found, in practice, says the patentee, that the coal-conveyors now in use dig or burrow in the coal in one spot in the hold on a line with the hatchway, but leave large masses of coal untouched at the sides or wings. The principal object of this improvement, therefore, is to provide a conveyor which will take the coal from all parts of the hold, even next the sides, instead of merely digging a hole in a single spot. This object is accomplished by means of a series of three conveyors; one (the main conveyor) being jointed, and the other two auxiliary conveyors being pivotally and otherwise adjustable.

APPLICATIONS FOR LETTERS PATENT.

7368.—Luther, W. H., and Bayley, E. M., "Burning hydrocarbon or other oils for lighting and heating purposes." April 19.

7379.—Boult, A. J., "Gas generators." A communication from H. C. Rew. April 19.

7514.—Breymann, W., "Regenerative gas-lamps." April 20.

7627.—Freeman, W. J. and E., "Preventing the deterioration of the air in an apartment or building in which gas is used for illuminating, heating, and other purposes." April 21.

7708.—Chandler, J. C., "Washing, purifying, and scrubbing gas." April 23.

Compensation for Fatal Injury to a Gas Workman.—At the last meeting of the Huddersfield County Council, the Town Clerk was authorized to pay £225 in full settlement of the claim of the widow of Christopher Kenny, who died from injuries received at the gas-works of the Corporation on Dec. 25 last year, as already recorded in the Journal (*ante*, p. 74).

Beverley Water Company—At the recent general meeting of this Company, the report presented by the Directors showed that the income for the ninth year of working, ending March 31 last, was £952. The working expenses were £536; and the profits £416. After the payment of interest on debentures and other preferential charges, amounting to £307, there was left a surplus of £109, which the Directors proposed to carry forward. The report was adopted, and general satisfaction was expressed at the improved prospects of the Company.

Newcastle and Gateshead Water Bill.—Last Tuesday, the Standing Orders Committee of the House of Commons had under consideration the proposal of the Newcastle and Gateshead Water Company to bring in a Bill dealing with the question of a proposed fish-pass, which they are required, under the previous legislation, to make, and in respect to which the Examiner had held that the Standing Orders had not been complied with. The prayer that these should be dispensed with was supported by the Corporation of Newcastle and Gateshead; but the Committee declined to grant it.

The Proposed Water-Works Extension at Bath.—The Local Government Board have addressed to the Bath Corporation a letter in reply to their application to borrow £18,000 for water-works purposes, in regard to which an inquiry has been held by Mr. S. J. Smith and Mr. E. P. Burd. The Board entertain great doubt as to the scheme at present before them being one in respect of which they will be able to sanction a loan. As, however, it is clear that it will be necessary for the Corporation to carry out additional works of water supply, they will be prepared to issue a Provisional Order extending their borrowing powers under the Local Act.

The Proposed Purchase of the Barnoldswick Gas-Works by the Local Board.—A meeting of ratepayers has just been held at Barnoldswick, to consider the proposed purchase of the gas-works by the Local Board. It was stated that the total income of the Company for the past year was £467, to which sum must be added the next dividend of 6 per cent. (£190), and a probable £60 before the close of the year. This brought the total to £617. It would be necessary to borrow £14,000; and after making the annual payment of interest on this sum, there would be left £94 in relief of the general district rate. At present there were only 310 meters in the town, out of a total of 930 houses and a population of 4131. A motion authorizing the purchase of the works at a price not exceeding £14,000 was carried by a majority of 47.

Charge of Stealing Coke.—The Ramsgate Magistrates have lately been occupied in investigating a charge of a serious character brought against one of the employees at the Corporation Gas-Works. The accused, named Frederick Yates, who had been in the service of the Corporation since 1878, had the issuing of the orders for the delivery of coke. The normal deliveries to a certain firm, regular customers of the Corporation, while Yates was on duty, were booked as 12 cwt.; but, during his absence for a short time on account of illness, it was found that they rose to 18 cwt.—falling again to 12 cwt. on his return. These variations aroused suspicion; and the result was Yates's summary dismissal and the institution of proceedings against him. He was prosecuted on two charges—one of larceny, and the other of falsifying the books; and, after an inquiry extending over several days, he was committed for trial at the Sandwich Quarter Sessions. The firm to whom the deliveries of the coke were made (Messrs. W. and F. Drayson) were also charged with conspiring with Yates to defraud the Corporation; and they were also committed for trial. All were, however, admitted to bail.

The Quality of the Metropolitan Water Supply in March.—The report to the Official Water Examiner for the Metropolis (General A. de Courcy Scott) on the quality of the water supplied by the London Water Companies during the month of March, as shown by samples taken daily for analysis, states that of the 186 samples examined, the whole were found to be clear, bright, and well filtered. The satisfactory character of the supply, which had been commented upon in previous reports, was continued; the quantity of organic matter present in the Thames-derived water being substantially indentical with that recorded in February, though just a trifle higher. The report is signed by Professor Crookes and Dr. Odling only—no successor to Dr. Tidy having been appointed. With regard to their late colleague, these gentlemen express their sense of the loss they have sustained by his premature death. He was esteemed, they say, not only by themselves, but by all with whom he was brought into relationship, alike for his great professional knowledge and experience, especially in regard to the analysis of water, and for his bright, kindly disposition and high personal character.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Standards of Light Committee.

SIR,—In an article which appeared recently in your JOURNAL, under the heading "Further Work for the Standards of Light Commission," is a sentence which I think must have been written under some misapprehension. It is this: "Gas managers have heard of pentane holders that required to be kept warm by steam-pipes." A statement of the same kind, as to the need of steam-pipes, appeared in your columns some months ago; and thus no doubt gas managers have heard of it. But actually pentane air-gas is unaffected by any fall of temperature down to the freezing point of water. Probably the statement had its origin in an imperfect recollection of an experiment made by the former Committee on Standards of Light, in which the light of the pentane flame, when the holder was heated by a steam-pipe, was compared, and found to be identical, with that of the pentane flame under ordinary conditions. The object of the experiment was presumably to try what effect very hot weather might have.

May I add two questions relating to another paragraph in the same article? Is not "the brightness of the screen when illuminated both sides by two 16-candle flames at either end of a . . . 100-inch photometer bar," the same as when gas is tested in an Evans photometer with a pair of candles? Is not the range of the screen, for a difference of one candle, when two 16-candle lights are compared, greater, and not less, than when the standard gives a light of only two candles?

Christ Church, Oxford, April 29, 1892. A. VERNON HARCOURT.

Steam-Pipes for Pentane Holders.

SIR,—In an article in last week's JOURNAL, headed "Further Work for the Standards of Light Commission," the writer states that "gas managers have heard of pentane holders that required to be kept warm by steam-pipes." I have had some experience in the use of pentane air gas, and have for the last year daily used it in this College for testing the Manchester coal gas. I have never heard of the necessity of steam-pipes to jacket the holder. I can understand if the temperature of the photometer-room falls below the freezing point, that the water in the pentane-holder will freeze; but so also will the water in the coal-gas meter and governor freeze. The pentane-holder therefore requires a steam-jacket just to the same extent that the coal-gas meter does—neither more nor less.

I imagine the origin of the steam-pipe fable to be this: In the long investigation carried out by the Board of Trade Committee in 1879-1881, the question was discussed as to what would be the effect of an abnormal rise of temperature on the quality of pentane air gas standing over water. To answer this question, a pentane-holder was surrounded by a coil of pipe through which steam could be blown. Several gas managers saw the apparatus at the Old Kent Road station of the South Metropolitan Company. Is it not possible that the image of the coil remains in their memories, while the object of the experiment has faded away? H. B. DIXON.

The Owens College, Manchester, April 29, 1892.

The Present Position of the Gas-Works Rating Question.

SIR,—In his article with the above title in this week's JOURNAL, Mr. Norton H. Humphrys is quite wrong in the definition he gives of "rent" and "rateable value." The assessment question is, in itself, sufficiently intricate, without adding to existing difficulties by a confusion of terms.

Mr. Humphrys states as a "fact" what is not a fact at all—that "the law lays down, as a first principle, the rule that the rateable value should be equal to the rent which a tenant would be willing to give for the property from year to year." And farther on in the same article he asserts that "the rent is the same amount as the rateable value." This is inaccurate and misleading. It is clearly set down in the Parochial Assessment Act, 1836, sec. 1, that the rateable value is the amount remaining *after deducting from the rent* the probable average annual cost of repairs, insurance, and other expenses. Again, the Union Assessment Committee Act, 1862, sec. 15, expressly states that "the gross estimated rental . . . . shall be the rent at which the hereditament might reasonably be expected to let from year to year." Further, the Valuation (Metropolis) Act, sec. 4, substitutes the term "gross value" for "gross estimated rental," and defines it as "the annual rent which a tenant might reasonably be expected, taking one year with another, to pay for the hereditament."

Clearly, then, it is the gross estimated rental, or gross value, which is the rent payable by the tenant; the rateable value is the amount remaining after making the statutable deductions necessary to maintain the hereditament in a state to command such rent.

5, *Norfolk Street, Manchester, April 28, 1892.* THOS. NEWBIGGING.

The Cost of Enriching Gas by Carburetting.

SIR,—Perhaps Mr. F. W. Clark will kindly add to the information contained in his paper presented at the recent meeting of the South-West of England Association replies to the following questions:—

1st. In how many gas-works is the price for cannel mentioned by him paid?
2nd. Why does he not give credit for the value of the residuals and coke from such cannel?
3rd. What evidence, of an independent and trustworthy character, exists to prove that the oil which he calls "carburine" will evolve 100 feet of perfect gas of 100 candles per gallon, or add by candle to 10,000 feet of gas?
4th. By what photometer was the value of this extraordinary oil gas ascertained?
5th. How much of this oil gas is condensed back into the mains?
6th. By what means has the amount so condensed been ascertained?

In the absence of a sufficient reply to these obvious queries, I am afraid that Mr. Clark's paper is useless.

Manchester, April 28, 1892. BLACK COAL.

Reduction in the Price of Gas-Tubes.—The English and Scotch Wrought-Iron Tube Association have lately issued circulars greatly reducing the prices, owing to German competition.

The Mansfield Woodhouse Gaslight and Coke Company, Limited, has been registered with a capital of £2050, in £10 shares. The Company was originally registered in March, 1855. The object is sufficiently indicated in the title.

The Expenditure on the Vyrnwy Water-Works.—The amount of expenditure in connection with these works up to March 31 last was £2,116,867. This includes, for the Vyrnwy embankment works and works in connection with the reservoir, £534,898; the Vyrnwy quarry, £201,262; the aqueduct, £1,062,832; land and easements, £282,413; maintenance of the Vyrnwy estate, £27,041; Vyrnwy Hotel, £8188.

South African Lighting Association, Limited.—The annual general meeting of this Company was held at the London Offices, No. 90, Cannon Street, on Thursday last—Mr. D. Ford Goddard, J.P., in the chair. In moving the adoption of the report and the payment of a dividend of 5½ per cent. (making, with the interim dividend already paid, 8 per cent. for the year) the Chairman pointed out that it would have been possible for the Company to have paid 10 per cent. out of its earnings for the year; but the Directors considered that, in view of strengthening the position of the Company, and of certain extra risks which a foreign company must necessarily run, it would be better to place the sum of £1000 to reserve, and to pay, as in former years, 8 per cent. The Chairman stated that the present price of gas was 12s. 6d. per 1000 cubic feet; and that a satisfactory result in the yield of gas per ton of coal carbonized was obtained on the works. He also alluded to the possible extension of the undertaking to another town in South Africa; and he stated that prior to this being carried out, the full negotiations would be laid before the shareholders. Mr. Corbet Woodall subsequently gave some further details of the proposed extension. After the re-election of Mr. J. Mansergh, C.E., the retiring Director, and the Auditor, the proceedings terminated with votes of thanks to the Directors and to the staff.

A Secretary Charged with Embezzlement.—On Monday last week, William David Melville Forrester, 39, secretary, was charged, before the Lord Mayor, at the Mansion House Police Court, with embezzling and stealing, on the 16th ult., £600 2s. 6d., the money of the Odessa Water-Works Company, Limited, his employers. Mr. Spokes, who prosecuted, said the defendant had been for some years Secretary to the Company; and on the 13th ult. a cheque for the above-named amount was handed to him to pay the Income-Tax Commissioners. On the 16th, the defendant had the cheque cashed, and on the following Saturday he took the money away with him. He was arrested at his residence the next morning, when the greater part of the money was found upon him, and it had nearly all been accounted for. If his Lordship thought fit to deal with the case summarily, the Directors would leave it entirely to his discretion. Mr. Allen, one of the Directors, stated that the defendant had been in the service of the Company for 21 years; his present salary being £350 per annum. Inspector Mitchell said that on the previous morning he saw the defendant at the police office in Old Jewry, in the custody of Detectives Bacon and Dowse. The defendant said he never intended to embezzle the money. The sum of £546 10s. in notes and gold was found on him; and since he had been in custody his brother-in-law handed witness £25. Detective Bacon said he arrested the defendant at half-past three o'clock on the morning of the 24th ult., at his residence. The defendant said his trouble arose through being a friend to others. He was the worse for drink, and had just arrived home while witness was watching. In reply to the Lord Mayor, Mr. Spokes said there was no other case against defendant. The Lord Mayor said he should not be satisfied to deal with the charge unless he felt sure of it. He should therefore remand it for the purpose of ascertaining for a fact whether it was a solitary case.

Sligo Gas Company.—A special meeting of this Company has lately been held to consider the advisability of obtaining a Provisional Order to increase the capital by £6000, and to acquire power to convert the concern into a limited liability Company. The Chairman (Mr. S. Cullen) explained that, owing to the increased consumption of gas during the winter months of the year, the present storeage accommodation was not sufficient; and the Directors had had several complaints of deficient supply. If the shareholders approved of raising the additional capital, it was proposed to erect a gasholder, enlarge the mains from the works to the Market Cross, and pay off the mortgage to the bankers. This would take about £3000. The Directors would require £1000 more for working expenses; so that if they had power to raise £6000, they only intended to issue shares for about £4000. Mr. J. O'Connor then moved—"That the Directors be instructed to take such steps as they consider necessary to have the Sligo Gas Company formed into a limited liability Company;" and the motion was carried unanimously. A proposition having been submitted that the Directors should take what steps they consider necessary for obtaining a Provisional Order, the Manager (Mr. C. B. Tully) made a statement showing the increased consumption of gas during the period from September, 1891, to February, 1892, and also the periods when there was no increase, owing to the works being unable to supply more. He estimated that the new holder and mains would cost about £1500; £1000 of the new capital would be needed for working expenses, and £1850 to pay off a mortgage. This made a total of £4350 of the new capital. He reckoned that after paying 5 per cent. on the proposed new preference shares, they would be able to pay 8 per cent. on the ordinary shares, and carry forward £160. The proposition was agreed to; and it was decided to offer the preference shares at 8 per cent. premium.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bill read the first time: Gas Provisional Orders Confirmation Bill (to confirm Provisional Orders relating to the gas supply of Cullingworth, Kempston, Mitcham and Wimbledon District, South Normanton and Blackwell, and Sutton and Hooton District).

Bills read a second time and committed: Bradford Corporation Water Bill; Liverpool United Gas Bill; Oxford Gas Bill; Southborough Local Board (Gas) Bill.

Bill reported: Bournemouth Improvement Bill.

Bill read the third time and passed: Blackburn Corporation Bill.

Petitions against the following Bills were presented:—

Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill, from the Guardians of the Poor of the Saddleworth Township.

Rhymney Valley Gas and Water Bill, from the Pontypridd Rural Sanitary Authority.

HOUSE OF COMMONS COMMITTEE.

Friday, April 1.

(*Before Mr.* CAMPBELL-BANNERMAN, *Chairman; Sir* W. HOULDSWORTH, *Sir* H. STAFFORD NORTHCOTE, *Mr.* R. K. CAUSTON, *Mr.* S. GEDGE, *Mr.* P. STANHOPE, *Mr.* POWELL WILLIAMS, *Mr.* W. JAMES, *and Mr.* E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

The proceedings on this Bill (see *ante*, p. 758) were continued to-day.

Sir *T. Martineau*, further examined by Mr. BALFOUR BROWNE, detailed the manner in which the proposals of the Water Committee were submitted to the Council and the general public, and stated that every opportunity had been afforded them for becoming acquainted with the scheme. The Council were unanimously in its favour; and at the ratepayers' meeting, it was agreed to by a large majority. This result was subsequently confirmed by a three days' poll, the outcome of which was a majority of nearly eight to one in support of the Council's proposals. The total estimate of the Engineers for the whole of the works was as follows: For the Elan and Claerwen scheme, £5,654,953; for reservoirs (Northfield and Warley), £86,250; extensions of mains and improvements of present supply during the next 10 years, £195,000; extensions of mains during the following 40 years, £480,000; addition made to cover cost of land, £183,797; amount provided in the Bill, £6,600,000. Of this there would be required during the next 10 years (during which the first instalment of the works with two lines of pipes would be carried out): First instalment, £3,340,700; reservoirs (Northfield and Warley), £86,250; extension of mains and improvements of present supply, £195,000—total, £3,621,950. Some addition might have to be made to this sum, in case of the purchase of additional land, out of the £183,797 provided for that purpose. It was intended that the future instalments of works should be added as required. Mr. Mansergh's expectation was that the second instalment, which would include the third line of pipes, would be wanted by 1908; the third or fourth line, by 1921; and the fourth or fifth line, by 1931. His estimate provided for the expenditure on these instalments running over about four years in each case. As to the local requirements, the reservoirs at Northfield and Warley were needed for the better supply of the high-level districts. Both sites were at a greater elevation above the sea than any of the present reservoirs. With reference to the extension of mains, experience showed that for the development of the works the Committee required about £12,000 each year. The item of £195,000 provided a margin to cover improvements in the present works (such as fresh headings from some of the wells), so as to carry the city on during the construction of the new works. As to all these local requirements, further borrowing powers were needed. The general financial scheme for bearing the annual burden to be occasioned by the proposed outlay for all purposes showed that it could be met by these different factors: (1) The natural growth of the water revenues; (2) an addition to them by an increase in the charges; and (3) the saving to be effected in the annual cost of pumping.

The CHAIRMAN: Are you now charging up to the extent of your powers?

Mr. BALFOUR BROWNE: Oh, no. We are not seeking powers from Parliament to increase our charges.

Witness: As a matter of fact, we shall only reimpose charges which we remitted in 1882-4. We reduced them so boldly, indeed, that for several years we were incurring a deficiency. The amount we have remitted is equal to £33,000 a year; and that which we propose to put on again is £28,000 a year.

In further examination, witness said, with regard to the natural growth of income, he thought that the rate shown in the estimate was reasonable. The estimate was as follows: From 1891 to 1900 inclusive, 3 per cent.; 1901 to 1910, 2¾ per cent.; 1911 to 1920, 2½ per cent.; 1921 to 1930, 2¼ per cent.; and 1931 to 1940, 2 per cent. The rate of increase from 1876 to the end of 1889 showed nearly 4½ per cent.; but this was hardly fair, as the earlier years were under exceptional circumstances. From 1886 to the end of 1889, it had been 3⅜ per cent. He believed it was now growing more rapidly. Mr. Mansergh's figures were based on the statistics up to the end of 1889. Calculating at the 3 per cent. rate, he estimated the rental for 1890 to be £132,720. When the Committee made up their accounts for 1890 (*i.e.*, to March 31, 1890), the rental was found to be £135,134; and 3 per cent. would have given an increase of £3866. The actual increase was £6280, or at the rate of 4¾ per cent. It was intended that the increase in the annual charges should be made at once. This would give time for a considerable annual surplus to accumulate. The saving in the cost of pumping would be £20,000 a year.

Cross-examined by Mr. PEMBER, witness stated that the Corporation proposed to take the house of Mr. R. L. Lloyd, who had manorial rights covering upwards of 20,000 acres of the land to be acquired, and also his gardens, together with a village of 180 inhabitants, and 1400 acres of enclosed land. He admitted having heard that Mr. Lloyd had sold of late years a considerable property in another part of Wales for the purpose of spending the money on this estate. Mr. Gray, in his report, did not say that the existing sources of supply could be retained for 20 years. What he said was that, if they could be retained, they would be equal to the growing requirements. There was at present an average daily surplus of 3 million gallons of water.

Mr. PEMBER: But your average daily supply being 3 million gallons in excess of your average daily consumption, there is often a large reserve in store, is there not?

Witness: Yes; but then the store may be exhausted, which it nearly was last year. That was an exceptional case, but one which may occur again this summer or next winter.

Cross-examination continued: Wolverhampton and Worcester had approached the Water Committee as to the possibility of buying some of the supply from Birmingham; and he had had a private inquiry from Bewdley. It was true that, in his speech to the City Council, he said that there was a most imperative reason for not dallying with the matter—namely, what was being done by London. But he was then endeavouring to put before the Council the position in which they would find themselves if, instead of the present scheme, they adopted a temporary expedient.

Mr. PEMBER: Quite so. If you did not jump in and take the water at once, London might acquire it?

Witness: I desired to show that it would be bad policy to adopt a temporary measure.

Did you not put it as an important factor that London was considering the advisability of obtaining a supply from Wales?—Yes; but I wish you to understand that I never said we were moving because of what was being done in London.

In reply to Mr. A. T. LAWRENCE, witness said the Elan and Claerwen were among the most important tributaries of the Wye. The water compensation proposed to be given would leave to Hereford a better river than the city had at present. It was compensation to the riparian owners for the "flow." He knew that Hereford had waterworks on the Wye supplied from that river; but he did not know what the proprietary rights of Hereford in the river were.

Mr. LAWRENCE: But, apart from that, can you tell me of any single case in which a stream appropriated for one community has been taken away for the benefit of another?

Witness: Until I know what the rights of Hereford are, I cannot answer that question.

Cross-examined by Mr. C. J. EDWARDS, witness said it was alleged that the scheme had been hurriedly pushed through at Birmingham. He emphatically answered that there was no foundation for this allegation. It was quite true that, in a speech he delivered in April, 1891, he mentioned 4 millions as being the amount which it might cost to carry the scheme through. This sum, however, was given as an illustration, in order that they might work out a financial plan. It was true that between April and October neither the public nor the Council had any materials before them as to the cost of the scheme—nothing except a sort of speculation that had been put in. Witness thought that there were from 300 to 400 people at the ratepayers' meeting. Questioned as to the increased demand for water, witness did not think this had been caused lately by the closing of wells, because many of them were closed shortly after the Corporation took over the undertaking. As to the suggestion about utilizing the Severn and the Trent, witness believed there could hardly be a more substantial reason against this course than the fact that the rivers ran through a contaminated district. The system of double mains had not been considered in the reports, because it was altogether too feeble a scheme.

By the CHAIRMAN: The ratepayers' meeting was held in the Town Hall, which was capable of holding 3000 people; but only 300 attended. But he took that as implying acquiescence on the part of the community, as the voting was eight or ten to one in favour.

Mr. GEDGE: If there had been strong opposition, people would have attended?

Witness: Yes.

Mr. *Lawley Parker*, the Mayor of Birmingham, gave corroborative evidence. He said the two previous polls of the ratepayers—in April, 1874, and December, 1883—brought together only 1902 and 5713 voters respectively, though the latter was marked by an organized opposition, and the former had relation to the expenditure of £2,000,000 in the purchase of the gas-works. Birmingham manufacturers were not large users of water; so that even if it were possible that they should suffer from a general depression of trade, the demand for water would hardly be diminished.

Cross-examined by Mr. LAWRENCE, witness said he would be surprised to learn that the water proposed to be taken had already been given by Parliament to the city of Hereford.

By Mr. POWELL WILLIAMS: The scheme was promoted not only because it was thought that the population of Birmingham would continue to increase, but because the present sources of supply might become unsuitable. The actual cost of the scheme, according to the last estimate, had been made known before the poll was taken.

Monday, April 4.

Mr. *J. Mansergh*, M.Inst.C.E., examined by Mr. POPE, said he had been acquainted with Birmingham for 20 years; and he assisted Sir Robert Rawlinson in the report presented by that gentleman in 1871. It occurred to him then that the Elan district, being at a considerable elevation, might not be unsuitable for the highest of large towns in the country; but the distance from Birmingham was so great that he first of all critically examined such available streams as were nearer—viz., the Severn, the Teme (above Knighton), the Ithon (above Llandrindod), and the Wye (above Rhayader). To each there were certain practical objections. The Severn was too low, and not sufficiently pure; the Teme collecting area was insufficient; and the Ithon, above the necessary height, was likewise inadequate. He therefore reverted to the Elan, with its tributary the Claerwen, which he had first observed while engaged on railway work in Wales; and Sir Robert Rawlinson agreed with him. When the report was presented, the water-works were not under

the control of the municipal authority; and since acquiring them the Corporation had for a while been content. But in 1890 he received instructions to advise, on his own part, as to the provision of water—first for the needs of 25 years, and secondly, for 50 years. The distribution area was 83,221 acres, and its population was 647,972, of whom at the end of last year 604,036 were supplied. Witness went on to describe the water-works by which this area and population are served. In reply to a question interpolated by the Chairman, he said that the surface water at present collected came from highly-cultivated ground. He estimated the minimum available supply at 19¼ million gallons per day. This was the only safe figure which could be taken, though Mr. Gray had named 20¾ millions. He had been sanguine enough to promise the Water Committee that, if the Act was obtained this session, water might be had in Birmingham by Christmas, 1900; but they could not safely calculate upon an earlier date than the spring of 1902. If his first promise were fulfilled, more would be done in the time than ever had been accomplished in this country. Before then the Water Committee (drought and frost apart) would be in grave difficulties; and not a single day ought to be lost before making a start. By the time the new works were expected to be finished, the minimum daily quantity of water required would be rather over 21 million gallons; and the maximum, 26 or 27 million gallons. In other words, there would be a deficiency of 2,154,000 gallons a day at the best, and of over 7 millions at the worst. He was convinced that every care had been taken to avoid waste of the present supply. The domestic consumption in London was 24¾ gallons per head per day, though the Companies were very careful; whereas in Birmingham it was only 17 gallons. It would, however, certainly increase from the extending use of water-closets and baths in low-rented houses. As to the possibility of augmenting the supply from present sources, the Bourne could not yield more than a net quantity of 1 or 1½ million gallons a day additional; while the Blythe and Plant's Brook would give no more. He had satisfied himself that no considerable increase of underground water could be obtained; and that some of the existing wells were getting foul, and might soon have to be abandoned. Pumping from such wells caused the water to become harder, and otherwise to deteriorate in quality. The outside additional yield would be 3 million gallons a day, even if the quality were good, and could be kept so. As to the dual system of supply which had been suggested, it was utterly unworthy of a place like Birmingham. It meant duplicate reservoirs, mains in all the streets, and services in every house. Moreover, it would be impossible to prevent the indiscriminate use of the two waters. There was such a system in Paris; and when the spring water failed, the dirty water of the Seine was turned into the pipes conveying the spring water. As to temporary provisions in general, he was of opinion that, in order to justify the expenditure of capital, provision should be made for 50 years at least. As Birmingham was on the average 300 feet higher than Liverpool or Manchester, her case was much more difficult than theirs, and her choice of gathering-grounds more limited. London, for example, could command a much larger choice, with equal advantage. All the schemes hitherto devised for London had been arranged for the delivery of water at elevations varying between only 220 and 300 feet above Ordnance datum. If London was to be preferred in this matter, she would take an area which she did not necessarily need, and which was practically the only one open to Birmingham. With reference to the engineering features of the scheme, the covering of Mr. Lloyd's house with water was an inevitable necessity. Mr. Lloyd was bound to be drowned, or the scheme to be thrown over; for it would be the height of folly to go to an enormous expense for the construction of works without utilizing all the water that the drainage area would yield. In the course of his description of the scheme, witness put in blocks of marble and other rock taken from the strata of the gathering-ground, and said that, with the exception that it was slightly stained with peat, the water was absolutely pure, as well as soft. He had at first estimated that the watershed area extended over 45,562 acres; but he found that a deduction must be made, because a right of user had been acquired to divert the water from 800 acres into Cardiganshire for certain mines. He reckoned the net extent of area available for collection at 44,000 acres. The rainfall, taken for 21 years by Mr. Lewis Lloyd and his father at Nantgwilt, at a height of 768 feet above Ordnance datum, was 63 inches. Observations were also taken by Mr. Symons and himself at three other places during twelve months. At 1040 feet, the rainfall was 70·9 inches; at 1281 feet, 68·2 inches; and at 1197 feet, 69·55 inches. His opinion was that it would not be safe, however, to calculate on getting more than the average rainfall of three consecutive dry years—viz., 56 inches; and as it was impossible to construct reservoirs of sufficient capacity to equalize the rainfall of more than three such years, and almost certain that during this period some water would be wasted by overflow in times of flood, he dared not estimate for collecting more than 36 inches. This would produce a daily average yield of 99 million gallons. Yet at extreme times the yield from the Elan to the Wye was as low as 2½ millions.

Mr. POPE: You are going to give water when the river needs it, and to impound water when, in times of flood, its free escape would do damage?

Witness: Yes; we shall send down an equal flow of 22 million gallons a day; and, in my opinion, that is an adequate compensation. All the way down to Chepstow there are only six little towns, and their population has fallen from 36,587 in 1881 to 35,903 now. As to Hereford, where the population is only 20,267, the quantity of water pumped for drinking purposes would not exceed 600,000 gallons a day, which is 100 times less than the dry-weather flow.

Whatever right they have to the water, you do not propose to take that right from them?—Oh, no. We had the same fight in the case of the Bradford Water-Works last year but one. York was similarly situated to Hereford; but got nothing. York was content, as all other places have to be content, with compensation water. We are going to spend on this water about £300,000, and to supply the water in a better and far more useful form.

In further examination, witness proceeded to describe the reservoirs proposed to be constructed, the gradual progress of installing them, and the proposal made to complete the cut-and-cover work, but to lay pipes only as necessity demanded. Thus the capital would be expended as occasion required. He put in a table upon which this was worked out year by year, and which showed the reimposition of the remitted charges. There would, he added, be a saving of £60,000 a year in soap alone, owing to the reduced hardness of the water; and if the saving in fuel which would be effected by reason of boilers being kept free of incrustation were taken into the computation, it would be apparent that by these economies the community, as a whole, would be able the earlier to pay instalments of interest and sinking fund. As to the likelihood of towns on the line of route requiring some of the surplus water, he thought it would be fairly assumed, after what had been heard from Wolverhampton and Worcester, to amount at no very remote period to 9 million gallons a day.

Mr. POPE: Reverting to the dual system, is there, irrespective of difficulty, any guarantee that the underground water to be reserved for a dietetic supply under that system would remain unimpeachable?

Witness: No; the chemists who have examined it say that one of the wells has nearly arrived at such a state that it should be abandoned.

Supposing you could continue them for a dozen years, would it be prudent to defer taking other steps till then?—Oh, no. Supposing Birmingham muddled on until then, she would probably find that the only really suitable ground would have been taken away from her.

Cross-examined by Mr. MOON (for the Wye Fishery Board), witness said that, assuming the rainfall had been wrongly computed, there might be a minimum supply of more than 99 million gallons a day; but the reservoirs would be constructed on the lower supposition. To raise the walls of the reserviors 3 feet would mean an increase of the storeage capacity by 800,000 gallons an acre. If the Bill passed, Birmingham could utilize in this way a larger quantity of water than he had hitherto spoken of, and could do so without increasing the compensation to the Wye. But this would mean an increase in the cost.

Mr. MOON: You spoke of 50 years as a reasonable time to provide for, and yet I see, from the table you have put in, that even in 1942 you will have more water than you can estimate that you need?

Witness: But the end of the world is not to come in 1942.

At all events, the increase of the Birmingham demand may have ceased by that time, may it not?—I think that is not at all likely.

Cross-examination continued: It was all nonsense to say the Wye fisheries would be damaged by the scheme proposed in the Bill. The Wye was not so important a river as the Severn, and therefore should not be compensated. Why Birmingham should be mulcted of £150,000 for the sake of a few rod fishers, he could not conceive.

Mr. MOON: Let me put it the other way about, and ask why the owners of property on the Wye should be mulcted for the sake of letting Birmingham have more water than she wants?

Witness: I do not believe they will be hurt a penny's worth.

By the Hon. A. LYTTELTON (for Mr. R. L. Lloyd): He had, of course, looked about to see whether it would be possible to place the reservoir anywhere else than at such a point as to drown Mr. Lloyd's church and house. In Birmingham, out of 25¼ gallons of water per head used every day, 17 gallons were for domestic purposes. The question of hardness was therefore very important.

By the CHAIRMAN: The Elan water alone, *plus* the Caban Loch reservoir, would only last until 1906.

The Committee adjourned till the next day.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, April 27.

(*Before Justices* DAY *and* CHARLES.)

The Surbiton Improvement Commissioners v. The Governor and Company of the Chelsea Water-Works.

This action came before the Divisional Court by way of a special case, from which it appeared that the plaintiffs sought to recover £63 12s. 11d.; being the amount at which they alleged the defendants were liable to be rated in respect of the general sewer rate made by the plaintiffs as the Local Authority on April 29, 1889. The sum was made up of the following items: General sewer rate, at 3d. in the pound—works, &c., £59 3s. 6d.; 15 cottages, £2 11s. 9d. General sewer rate, at ¾d. in the pound—on mains, £1 14s. 8d.; on land, 3s. It appeared that prior to 1855 the defendants, in connection with the Lambeth Water Company, had, in order to prevent sewage being discharged into the River Thames above their intakes, constructed and maintained, at their own cost, two sewers for draining the works and property of the two Companies, and also for intercepting the drainage of the adjoining houses. The defendants also put down a sand-washing drain for the purpose of draining their filter-beds. In the years 1859 and 1860, the plaintiffs constructed the main sewers in their district. Prior to April, 1889, plaintiffs did not seek to impose any general sewer rate on the defendants. Subsequently to 1855 various Acts of Parliament were passed for the better purification of the Thames; and by section 63 of the Thames Navigation Act, 1886, the discharge of sewage into the river was absolutely prohibited. Prior to the passing of this Act, the plaintiffs and defendants had discharged sewage direct into the Thames by means of the sewer constructed by them. Pursuant to the provisions of the Act of 1866, the Thames Conservancy in the year 1867 served notice on the plaintiffs and defendants and the Lambeth Water Company, calling upon them to discontinue the discharge of sewage into the river, and further notices to a similar effect were given in the years 1869 and 1884. The plaintiffs, in order to prevent the sewage flowing from their district into the Thames, did in 1889, at a cost of about £11,200, cause a new outfall sewer to be made, for conveying the sewage of Surbiton to the purification works at Kingston; and in order to drain the premises of the defendant Company, situate on the Portsmouth Road, the main sewer made by the Improvement Commissioners had to be continued along the road. Prior to the construction of the sewer, a portion of the defendants' property consisted of four cottages on the north side of the Portsmouth Road; and the Engineer's residence and the Company's office, on the south side of that road, as well as two cottages belonging to the Lambeth

Water Company, and situate to the west of the defendants' houses, drained into the sewer of the Lambeth Company (since disused), which ran at a lower level than the new sewer constructed by the plaintiffs. But for the existence of the above-mentioned property, there would have been no necessity to carry the new sewer beyond the houses situate to the east of the defendants' property. The plaintiffs were of opinion that, in consequence of the prohibition against the discharge of sewage into the Thames, the sewers of the defendants did not sufficiently drain their works and property situated within the plaintiffs' district. In 1888 and 1889, new branch sewers were constructed in the Fleece Road by the plaintiffs, by agreement with, and at the expense of the defendants and the Lambeth Company, in order that the defendants' works and property, and a considerable number of houses situate in the Brighton Road, might be drained into the plaintiffs' main outfall sewer, and thence to the new outfall works. If the defendants had not been allowed to discharge the sewage from their works and property into the main outfall sewer of the plaintiffs, the defendants would have had to find some other means of disposing of their sewage than allowing it to drain into the Thames. As to the sum of £1 17s. 8d. in respect of mains and lands within the limits of the Act, the defendants admitted their liability, and also that the four cottages situate north of the Portsmouth Road were liable for sewer rate; and they accordingly paid 13s. 4d. The £61 1s. 7d., being the residue of the amount claimed, was demanded in respect of the filter-beds and other buildings situate north of the Portsmouth Road, in respect of the works, buildings, and land situate between the Portsmouth and Fleece Roads, and also in respect of the buildings and land situate between the Fleece Road and Balaclava Road. The plaintiffs contended that the defendants were liable to pay sewer-rate in respect of all their property within the plaintiffs' district, irrespective of such property within the boundary of the defendants' works; and that the property being enclosed within walls or fences belonging to the defendants did not exempt it from being rated. The defendants contended that they were not liable to pay sewer-rate for any of their property comprised within the present boundary walls or fences, which were alleged to be "fence walls" within the meaning of section 24 of the Act, which provided that the Commissioners could not levy any sewer-rate on "property of the defendants and the Lambeth Company which for the time being should be comprised within the fence walls of the works of the Company, and in respect of any other property of the Companies which, in the opinion of the Commissioners, may be sufficiently drained into such sewers or drains of the Companies or either of them." It was agreed that, if the Court should be of opinion that the defendants were liable to be rated in respect of all their property within the limits of the Act, judgment should be entered for the plaintiffs for £61 1s. 7d., with costs.

Mr. MEADOWS WHITE, Q.C., and Mr. M. SMITH appeared for the plaintiffs; Mr. LUMLEY SMITH, Q.C., and Mr. C. MATHEWS for the defendants.

Their Lordships decided in favour of the plaintiffs; but granted a stay of execution with a view to an appeal.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Guildhall, Wednesday, April 27.

(*Before Mr. Justice* WRIGHT *and a Special Jury.*)

Pope and Pearson v. Buenos Ayres (New) Gas Company, Limited.

This case involved a point of special interest to foreign gas companies; it being an action brought to recover £3226, the price of two cargoes of coal, or, in the alternative, £3500 damages for their non-acceptance—the contract for the coal having been cancelled by the defendants on the ground that a mistake had been made in a cablegram transmitted from their Manager at Buenos Ayres (Mr. Lewis T. Wright) to the Secretary in London (Mr. E. W. Layton).

Mr. BIGHAM, Q.C., and Mr. LECK appeared for the plaintiffs; Mr. FINLAY, Q.C., and Mr. BOWYER for the defendants.

Mr. BIGHAM, in opening the case, said the action was brought by Messrs. Pope and Pearson, of Normanton, and also by Messrs. Walford and Co., of Antwerp, against the Buenos Ayres Gas Company, who had offices in London, to recover the price of two cargoes of coal. It appeared that the two firms mentioned were jointly interested in these cargoes, which were shipped by them to Buenos Ayres on speculation, in vessels known as the *Superbo* and the *Nadeshda*. The coal was consigned to an agent named Arabehety; and, as it was not sold on its arrival, he put it into store. The first-named vessel reached Buenos Ayres in March, 1891; its cargo consisting of 695 tons of Silkstone coal. The second vessel arrived in the following May; and had 564 tons of coal on board. The cost of the coal free on board at Swansea was 12s. 6d. per ton; and the freight was 20s. per ton. This was a very material point. Then there were the landing and storing charges to be taken into consideration. The coal not having been sold, the plaintiffs were, of course, anxious to dispose of it. This led to Messrs. Walford and Co. suggesting to Messrs. Pope and Pearson that it should be sold at cost price, leaving Mr. Arabehety to fix the sum with the contractor. Accordingly Mr. Jones, a representative of the latter firm, wrote to Mr. Layton, the Secretary of the defendant Company, asking him whether they would, as a favour, instruct their Manager to take the cargoes. Mr. Layton replied, requesting that certain particulars regarding the coal should be sent to him; and the plaintiffs answered to the effect that it was Silkstone coal, exactly similar to what had been sold to the Company in former years. On the 7th of July, Mr. Jones had an interview with Mr. Heseltine (the Managing Director of the Company), Mr. Easton (the book-keeper), and Mr. Layton. In the course of the conversation, the last-named gentleman said he could not make an offer off-hand, as he did not know the condition of the coal, nor where it was stored; but he said he would cable out to their Manager (Mr. Wright), and, if the reply was favourable, they would make one. Mr. Easton suggested that, as the inquiry was being made at the plaintiffs' request, they ought to pay the cost of the telegram (which would be £4 or £5); and this Mr. Jones agreed to do. The cablegram sent was as follows: "Will you take a consignment of 1250 tons of Silkstone Arabehety report value." On July 14, the answer came, "Silkstone yes *light* dollars fifty delivered." It now appeared that the answer which the Manager forwarded was written by him in this way: "Silkstone yes eight dollars fifty delivered." He (the learned Counsel) supposed the word "eight" was altered into "light" by the telegraph clerk. A letter was sent to the plaintiffs by defendants in which they purported to give a copy of the cablegram, with their own punctuation, as follows: "Will take Silkstone. Cargoes light, price 50 dollars delivered." Now at that time the value of the paper dollar was very low; and $50 would not have been an excessive price in paper. The $50 paper would work out to about $12½ gold, instead of the $8½ which there was no doubt Mr. Wright intended to wire. The dollar was worth about 4s.; while the paper dollar, after the misfortunes in Brazil, he was informed was only worth 1s. It did not at that time appear to the defendants that the $50 was excessive, because they wrote "kindly inform us if you will accept this price." The plaintiffs' reply was that they would have to submit the offer to Messrs. Walford and Co. Counsel then read a number of letters which had passed between Messrs. Walford and Co. and Messrs. Pope and Pearson; and he incidentally remarked that he read them because the jury would find that the defendants positively pleaded that the plaintiffs were guilty of some sort of fraud in the contract which was ultimately entered into. On July 18, it appeared that defendants wrote a letter to their Manager at Buenos Ayres, in which they stated that they had passed on to Pope and Pearson his suggested offer for the coal of $50 paper delivered on the works, and were waiting their reply. In answer to telegrams sent by Messrs. Walford and Co. to Arabehety, he advised them only to accept $50 at the depôt, or $53 delivered at the defendants' works. Messrs. Pope and Pearson, on Aug. 7, wired to the defendants offering the coal at the latter price; and Mr. Layton replied that the matter should be laid before his Board at their next meeting. Plaintiffs again wrote on Aug. 13 inquiring what decision had been arrived at by the Board. On the same day a letter was received from Mr. Layton, asking whether the plaintiffs could not take the $50; and two days later Messrs. Pope and Pearson wired offering to settle the matter at $51½. On the following Monday, Mr. Layton wired that his Company would take the coal delivered at their works at $51½ paper, at that day's exchange. This was the whole story; and the defence was that the contract was brought about by a mutual mistake, and that therefore the defendants were not bound by it. But the plaintiffs had made no mistake at all about it, because they received what purported to be a copy of the telegram from Mr. Wright; and in Mr. Layton's letter they had a clear offer of $50. The contract was made between the principals of the Company in London and Messrs. Pope and Pearson at Normanton.

Mr. BOWYER, in reply to his Lordship, said that $51½ paper would be roughly £2 11s. 6d.; and $8 50c. in gold, £1 14s. The defence was this: That there was a common mistaken belief in the existence of a fact material to the contract which did not exist.

Mr. BIGHAM (continuing) said it would be remembered that on the 18th of July the defendants sent a letter to their Manager, in which they gave a copy of the telegram which had been received from him. This would take about a month to reach him; and on Aug. 18, when the letter was delivered, there came a cable from him as follows: "Market remains the same. Price of Silkstone eight dollars fifty gold. Do not pay more. Did not require unless great bargain." Defendants then wrote to Messrs. Pope and Pearson cancelling the contract, as it had been made under a misapprehension. It was suggested by the other side that the first telegram was sent at the plaintiffs' "risk." He agreed that it was forwarded at their expense, but no allusion was made at the interview on July 7 as to risk.

Evidence was then called for the plaintiffs.

Mr. *J. A. Jones*, the agent of Messrs. Pope and Pearson who had the interview with Mr. Heseltine, Mr. Layton, and Mr. Easton on July 7, related what then took place. It was true that he agreed to pay the expense of the cablegram; but he denied that the word "risk" was used in the course of the conversation. Mr. Layton asked him if he was in a hurry for the reply, because if not, their Manager would be telegraphing about other business in a few days, and he could then include his answer. He (witness) told him that they were in no immediate hurry.

Cross-examined: He was certain nothing was said about the payment for the reply. His firm applied to the defendants, asking them to take the coal off their hands, as a favour.

Thursday, April 28.

On the resumption of the proceedings this morning,

Mr. *Jones* was further cross-examined. At the interview he said he mentioned that the price of the coal delivered at Hull would be 11s. 3d., and the freight £1 0s. 9d. He gave that as the price they would be willing to take; and the difference between £1 12s. and $50 paper would be 18s. The £1 12s. was for the coal delivered c.i.f.; the $50 paper was for the coal delivered into the works. Asked whether the defendants after Aug. 17 did not express their willingness to pay the $8 50c., witness said they distinctly withdrew the offer. Mr. Layton, at an interview on (he believed) Aug. 26, said if he could not accept $8 50c. on the spot, he must withdraw the offer.

Mr. *Walford* was next examined. He stated that his firm was jointly interested in these cargoes of coal with Messrs. Pope and Pearson. The coal had now been sold under an order of the Court at $7 1c.; and it had realized a total of £1812. An order was made that, if they obtained an offer for the coal, it was to be submitted to the defendants first, in order that they might be allowed to make a bid. They received an offer of $7; and the defendants thereupon said they would give $7 1c., so that they were obliged to let them have the coal. There was another action pending with regard to the payment under this contract. If they had been paid at the price of the first contract, they would have realized £3226, instead of £1812.

In cross-examination, witness was asked whether the £1812 had not been paid less 10 per cent.; and he replied that he was not sure. The defendants alleged that the coal was damaged, and was useless for gas making.

This ended the plaintiffs' case.

Mr. BOWYER having called his Lordship's attention to various

extracts from the correspondence, submitted, first, that no case was shown by Messrs. Walford and Co.—they did not allege now that they were contractors; and, secondly, that there was nothing to go to the jury on the statements of his learned friend's own witnesses.

His LORDSHIP pointed out that Mr. Walford had stated that his firm were jointly interested in the coal in question; and it was not admitted that both parties were at all times acting under a common mistake.

Mr. FINLAY then opened the case on behalf of the defendants. He contended that it was very clear the whole of this transaction had proceeded upon a mistake; and the question was whether or not the defendants were to be bound to a contract which was entered into beyond all question under a misapprehension. The negotiations were initiated by Messrs. Pope and Pearson, who asked the defendants, as a favour, to take the two cargoes of coal off their hands. He should produce evidence to show that the telegram to the defendants' Manager and the reply from him were to be sent at the expense and risk, or responsibility, of the plaintiffs. Having referred to the wording of the telegram received from Mr. Wright, and the construction put upon it by Mr. Layton, learned Counsel said the result was that a contract was entered into at $\$51\frac{1}{4}$ paper money, which was nearly equal to $13 in gold. They had conclusive evidence that the total outside value of the coal at Buenos Ayres was £1 14s. per ton; while, roughly speaking, $\$51\frac{1}{4}$ paper was equal to £2 11s., or a difference of 17s. It was not therefore altogether surprising that on Aug. 22 Mr. Arabehety should write: "I congratulate you on the price obtained, as, on many occasions, I have offered coal to that Company at the price of $12 gold coin. . . and the only offer they made was $9 to $9\frac{1}{2}$ gold coin, as against $13 gold," which was, the learned Counsel added, the price on which the plaintiffs were seeking to make defendants liable. Under these circumstances, he asked, were the plaintiffs entitled to hold the defendants to this contract? He submitted that they were not. Supposing that, owing to a mistake, the price had been 17s. below the value at Buenos Ayres, could the defendants have held the plaintiffs to that bargain? Here there was a common mistake as to what was fundamental to the whole transaction; and as soon as it was discovered that the message from Buenos Ayres had not been correctly delivered, of course everything that had taken place upon it would have to be considered as rescinded.

Witnesses were then called on behalf of the defendants.

Mr. *Heseltine*, the Managing-Director of the Company, gave an account of what he remembered took place at the interview on July 7 last. He told Mr. Jones that the Company had sufficient stock at Buenos Ayres and afloat, and they had no need of the cargoes his firm had offered them; but, if they could be of assistance in helping them out of their difficulty, as old friends he was inclined to do so. In speaking of the cablegrams, witness said he pointed out to Mr. Jones that it was a very unsatisfactory thing to carry on negotiations in that manner. Mr. Jones wished to pay for the message then; but it was explained to him that they did not know what the cost of the answer would be, and so the matter was deferred.

In cross-examination, witness said he had been Managing-Director of the Company since 1875. It was scarcely necessary for him to know the market price of coal from day to day, as they entered into contracts for large quantities. At the time they made the offer for the coal, it did not occur to him that for what had cost the coal-owners £1 12s. at Buenos Ayres, they were giving £2 10s. It was distinctly understood at the interview that Mr. Jones was to pay for the words relating to the coal in the Manager's next cablegram. He agreed that there was nothing in the interpretation of the cablegram sent to Messrs. Pope and Pearson which would mislead them. The question as to the price to be paid for the coal was not submitted at a Board meeting, although Mr. Layton had stated in a letter that it would be.

By the JURY: The Company had not bought Silkstone coal since 1885 or 1886; and he did not remember the price they then paid.

Mr. *Layton* also gave a narrative of what took place at the interview in July 7; and it agreed with the statement of the previous witness. He understood by the cablegram from Mr. Wright that he would take the two cargoes of coal; that the word "light" meant that the cargoes did not weigh out to 1259 tons; and "dollars fifty," that the price was to be at $50 paper delivered. He communicated the cablegram to Messrs. Pope and Pearson in a way which he thought would be most intelligible to them.

Cross-examined: He understood the cablegram to mean what he had already stated. He admitted that it did not read; and that it might have been much plainer. It did not occur to him to send an exact copy to Pope and Pearson, in order that they might put their own interpretation upon it. They were now paying for their coal 9s. f.o.b. Newcastle; but it was a different class to Silkstone.

Mr. *Easton* stated that he had taken some particulars from the Company's books, showing their transactions in coal just before and after Aug. 17. He believed the average price was 9s. 3d. per ton; and the freight might range from 18s. to 20s. With regard to cannel coal shipped on the west coast, they paid from £2 2s. 6d. to £2 5s.; and then there would be the average freight to add. The cost of conveying their coal from the ships to the works would be about 2s. per ton; and, of course, they had no charges to pay for storeage.

Cross-examined: He made a memorandum as to what took place at the interview on July 7; but it was not made until after the dispute arose. In it he stated that it was arranged with Mr. Jones that the cablegrams were to be sent at the expense and risk of Messrs. Pope and Pearson.

The deposition which Mr. Wright had made in regard to the matter was then read by learned Counsel. It stated that the original copy of the cablegram had been produced before the British Consul at Buenos Ayres; and a copy of it was made in his (Mr. Wright's) press-book. The value of the coal on July 14, delivered into the works, would have been $8 50c. Directly he received the letter from Mr. Layton on Aug. 18, he sent a cablegram correcting the mistake. He could not recollect whether he forwarded a letter confirming his first cablegram.

Mr. *Layton* (re-called) stated that he did not receive a confirmatory letter from Mr. Wright.

Mr. FINLAY and Mr. BIGHAM having addressed the jury on the evidence,

His LORDSHIP summed up. He said that in this case a contract was made which was as plain and explicit as a contract could well be; and it would take a good deal to upset a contract of this sort. On Aug. 15, 1891, plaintiffs wired, asking defendants whether they would take the Silkstone coal in question at $\$51\frac{1}{4}$; and on the 17th, the Company telegraphed; and afterwards they confirmed it in writing: "Will take Silkstone, $\$51\frac{1}{4}$ paper, at to-day's exchange." Twenty years ago it would have been practically impossible to have got out of that contract; but now they had to look at these things as matters of what was called equity as well as in the strict law. The difference between the price at which the plaintiffs were offering the coal (£1 12s. 6d., *plus* charges) and the $\$51\frac{1}{4}$, which the contract price gave, if regarded fairly, was not so extraordinary as to suggest anything disadvantageous to the plaintiffs. It was clear they were quite ignorant as to what the charges would be at Buenos Ayres. They might well have thought that the Company's Manager would not telegraph a price of that kind without some good reason; and they might also have thought that the expenses out there were large. The plaintiffs, they saw, did not accept the $50 at once; and they, rather unwillingly, at last agreed to an additional $\$1\frac{1}{4}$. Then, on the other hand, the defendants, the instant they learned what their Manager really meant, corrected the error. Therefore they had nothing to do but to consider the substance of the case, and that depended upon what was agreed upon at the interview on July 7; and really there was very little conflict as to what happened on that day. He should think, and probably the jury would be of opinion, that it was arranged between Mr. Jones, and Mr. Heseltine, Mr. Layton, and Mr. Easton, that the defendants should buy the coal at a price fixed by their Manager in Brazil. There was no doubt a great deal to be said for the defendants' view, that the parties merely meant to act on the Manager's valuation. If the jury considered this was really the view, then they ought to say the contract of $50 was not binding; but if they thought there was a real intention on the part of both parties to contract for $50, then they ought to find for the plaintiffs. The learned Judge then read the following list of questions which he proposed to leave to the jury: (1) Was it verbally agreed, on the 7th of July, that the defendants should buy at their Manager's valuation? (2) Was the written contract intended by both parties to express and give effect to the verbal agreement (with 3 per cent. increase on the Manager's valuation)? (3) Did both parties at the date of the contract act in the belief that the Manager's valuation was $50? (4) Was the written contract intended to take effect only upon the supposition that the Manager's valuation was $50? (5) Or was the written contract intended to be absolute, without regard to the verbal agreement or the Manager's real valuation? (6) Would there have been any contract made on or about the 15th or 17th of August, if the defendants had offered only $8 50c. in gold, or thereabouts?

The jury retired; and, after an absence of about an hour, they returned into Court with the following replies: To the first question, "No;" second, "No, by eleven jurors, and yes by one;" third, "Yes;" fourth, "No, not by both parties;" fifth, "On the part of the plaintiffs, yes, but on the part of the defendants, no doubt they had their agent's valuation prominently in their minds, but in our opinion they neglected to take the most ordinary and obvious means of protecting themselves;" sixth, "Cannot agree to an answer."

Friday, April 29.

At the commencement of to-day's sitting,

Mr. FINLAY submitted that the answer of the jury to his Lordship's third question gave his clients what was necessary to get rid of the contract. Being answered in the affirmative, they had the finding of the jury that both parties at the date of the written contract acted in the belief that the Manager's valuation was $50; and it came to this, that the basis of the written contract was the belief that the Manager had valued the coal at $50 paper per ton, and this agreed with the evidence of Mr. Jones and defendants' witnesses. The answers to the fourth and fifth questions did not modify in any way, to his clients' prejudice, the one given to the third.

His LORDSHIP, in giving judgment, said there was no doubt the parties acted in the belief that the Manager's valuation was $50 paper; but the jury had found that one of the parties was not determined by that consideration at all, and as to the other party—the defendants—they neglected to take the "most ordinary and obvious means of protecting themselves." By which he understood the jury to infer that the defendants, instead of transmitting the original telegram to the plaintiffs, sent a copy made by themselves, which was wrong, and which amounted to a representation by the defendants to the plaintiffs that the Manager's valuation *was* $50 paper. If the original telegram had been sent, he could not help thinking that the plaintiffs would have been so puzzled that they would have wanted a correct representation of it. He therefore could not say the jury were wrong. There was not enough to enable him to relieve the defendants from the contract they had entered into in writing; and his judgment was for the amount claimed.

Mr. FINLAY remarked that the coal had been sold pending a settlement.

Mr. LECK said the amount which it had realized was given by Mr. Walford on the previous day. All they asked for now was £1453.

Mr. FINLAY applied for a stay of execution for a week; and, if there was an appeal, for a stay of execution until after it was heard.

His LORDSHIP agreed to a stay of execution for a week; the plaintiffs' solicitor undertaking to repay the money if so ordered.

Johannesburg Lighting Company, Limited.—In the JOURNAL a fortnight ago, reference was made to the extension of the concession of the above-named Company for supplying gas and electric lighting in Johannesburg. By the terms of this concession, no street lighting by either of these systems can be carried out by any public authority, except through the Company. Their position having been thus strengthened, they are now taking steps to meet the existing demands upon them and obtain fresh business. To do this, more capital is required; and they purpose raising it by the issue of 7 per cent. mortgage debentures of £50 each, convertible, at the option of the holders, into ordinary shares of the Company, and repayable at par on Dec. 31, 1901.

MISCELLANEOUS NEWS.

ASSOCIATION OF SULPHATE OF AMMONIA MANUFACTURERS.

Quarterly Meeting in London.

The Quarterly Meeting of this Association was held last Thursday, at the Offices of the Incorporated Gas Institute, 3, Victoria Street, Westminster—Mr. J. HEPWORTH, M.Inst.C.E., the President, in the chair.

The HONORARY SECRETARY (Mr. G. E. Davis) read the report of the Council, which included a statement of the quantity of sulphate of ammonia exported during each of the last six years, with the price for each year; and the same information, in more detail, for the past three months. It was pointed out that the greatest difficulty encountered in keeping up a fair standard of price was the considerable number of manufacturers, principally the smaller ones, who still hold aloof from the Association. Speculators, it was marked, seemed to be more united, and to support each other better than manufacturers; and whilst this continued, the efforts of the Association were necessarily much hampered. It was intended to approach the Royal Agricultural Society with the view of offering a prize for the best crop grown with sulphate of ammonia; and the members were invited to make other suggestions, with the object of developing the home trade.

The CHAIRMAN, in moving the adoption of the report, said the meeting had been called in the Metropolis with the idea of increasing the interest in the Association in the district; and he was glad to see many gentlemen present from works round London, as well as from other parts of the country.

The report having been adopted, a general discussion ensued, in which Mr. Ness, Mr. Jones (Chesterfield), Mr. Chester, Mr. Valon, Mr. Morton (Ashford), Mr. May, Mr. Parkinson, and other gentlemen took part.

The proceedings closed with a vote of thanks to the President.

In the evening the members dined together.

SAN PAULO GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Wednesday, at Winchester House, Old Broad Street, E.C.—Mr. FREDERICK DELMAR, F.S.A., in the chair.

The MANAGING DIRECTOR and SECRETARY (Mr. J. Heath) read the notice convening the meeting; and the Directors' report and the accounts for the half year ending Dec. 31 last were taken as read (see *ante*, p. 716).

The CHAIRMAN, in moving the adoption of the report, said the Directors met the shareholders on this occasion under very painful circumstances, having lost during the half year their respected and esteemed colleague, Mr. H. A. Cowper. He then proceeded to refer to the state of affairs at the Port of Santos; and, in doing so, quoted from an official list obtained from the German Consul. This showed that there were 69 ships at the port on Aug. 11 last waiting for a berth, as the discharging arrangements were inadequate for the increasing trade. This caused vessels to be detained for more than six months, resulting in heavy demurrage—from £1200 to £1500 per vessel carrying 1000 tons of coal, or more than double the cost of the coal. Besides this there was the epidemic of yellow fever, and the increase of wages and salaries owing to the expenses of living being much enhanced; and, in consequence, the owners of vessels refused to call at Santos with the Company's coal. The Directors were therefore driven to seek their coal supplies from various sources; and, after great efforts, they succeeded in obtaining them from Kentucky. They then had to scheme to escape the great cost of demurrage, which equalled the value of the ships; and, in the end, they purchased two ships on their arrival in port. By this means, they hoped they had released themselves from future demurrage; and so would gradually pay for the vessels out of the savings effected. As the cargoes now arrived in port, they were discharged into their own vessels when they became empty. There were other causes for increased expenditure. They had a loss of £11,682 (which, however, might not occur again) through having to write down the currency balances, &c., to 1s. 1d. per milreis on Dec. 31. The profits, he was sorry to say, had been reduced by more than one-half; being only 1s. 8¼d. per 1000 cubic feet, as against 3s. 8d. in December, 1890. Yet the business exhibited an increase of 33¾ per cent. over the second half of 1890, or a consumption of 62,211,000 cubic feet of gas, as compared with 46,454,000 feet. The rate of exchange had affected the Company by all the payments being made to them in depreciated paper currency—50 per cent. discount—while the gas supplied had cost more than double the usual sum to produce. The Board had also been greatly troubled by being restricted in the contingency, equalization, and reserve funds, from the fact that the shareholders had insisted on having at par the 5000 £10 shares issued in October, 1889, when they were offered at £5 premium; the old shares being at that time at £7¼ premium. The net revenue on the half-year's working was only £5516; and deducting this from the large loss in exchange, they had a net deficit of £5081, which the Directors considered it was equitable to write off the contingent account, so as to start the current half year on a fair and level basis. Referring next to the election of two new Directors (Mr. D. M. Fox and Mr. G. A. Hillier), the Chairman said that, under the complications before them, the Board felt it would be unwise to select any but those practically experienced; and fortunately they met with two gentlemen suited in every way to their purpose, and who were connected with the San Paulo Railway. One of those gentlemen had given the Directors a report on the Company's works; and therefore there could only be one opinion as to the wisdom of their choice. There were some shareholders who had expressed their disappointment, and implied that they had been ill-used, as they considered they had a prior claim to election. But he contended that they had no claim whatever beyond that of being shareholders; and, besides, they had not the least experience. Having reminded the shareholders that they had been paid an interim dividend of 5 per cent., the Chairman referred to the indications they had as to better prospects. In the first place, they were now working at a profit, which would be increased if they escaped the cost of demurrage. The price of gas had been raised 50 per cent.; and the charge for coke nearly doubled. These were, of course, immediate advantages; but there was also the prospect of something being done to improve the Port of Santos. On the 16th inst., a meeting was held in reference to that question, and a Committee was appointed, and sent to the Federal Government. They were received by the Minister of Agriculture; and the Financial Minister had expressed the hope that he would assist him in his endeavours to improve the condition of the port.

Dr. E. BATT seconded the motion.

A long and animated discussion followed; and the following summary will indicate its character.

An inquiry was made as to whether there had been any diminution in the consumption of gas since the price had been raised; and the Secretary replied that they had only the figures up to the end of February, which gave them two months' working, and the increase had been about 30 per cent. Interrogated as to the object of the reserve of £21,527, he said it was not a reserve "fund," but a reserve "account;" and it was used in the business as working capital. With regard to the demurrage suspense account (£3494), that was an amount which was in dispute, and had been paid into Court, pending an arbitration.

Mr. J. E. JONES said he had expressed the view on previous occasions that the amount standing to reserve account ought to have been invested; and, when the new shares were issued, he ventured to urge that it should be at a premium, in order that the shareholders might have a tangible sum with which to form a reserve fund. Now they saw that they had made a mistake. It must have been very saddening to the Directors to have had to appear before the shareholders with such a report as the present; but it was the first time they had had to come before them under such circumstances. The Board, in his opinion, had done the best they could in the interests of the Company in selecting Mr. Fox and Mr. Hillier as Directors. He hoped that the Directors would not on this occasion be unnecessarily harassed; but that the shareholders would do all they could to strengthen their hands.

Mr. ROBINS remarked that the Chairman had alluded to the interim dividend of 5 per cent. At the time they paid that dividend, the various adverse facts to which reference had been made were perfectly well known to them; and he thought it was a very unwise thing to do, looking at the position in which they now stood. He believed the shares were selling last July at £16; but to-day their market value was only about £8. In the past two years, the Directors had been authorized to raise £50,000 of fresh capital for new works; and yet the shareholders were now told that the reserve fund (which they supposed to be in cash) had also been spent on the works. While he did not want to do anything which would affect the prosperity of the Company, he thought some step should be taken, having regard to their present circumstances, to stop this large expenditure as far as possible.

Mr. FOWLER said that until recently he had regarded the Company's shares as a sound investment; and, as late as June last, he had increased his holding. He had thought they had able Directors to manage their affairs; but he had discovered that they were "utterly unreliable and incompetent." ("No, no.") On inquiring of his broker only the previous week as to why the shares had decreased to such a large extent, he received the reply that there was "an utter want of confidence in the management." In consequence of this, he wrote to the Secretary asking to be allowed to inspect the books. He called at the office, and was shown some of them, but others were withheld. He particularly wished to see the minute-book showing the attendance at the Board meetings, but he was not permitted to inspect it. [Mr. J. B. BATTEN, the Solicitor: Quite right, too.] He found from the cash-book that the Directors received £1000 per annum for their services. [Dr. BATT: It was voted by the shareholders.] Now in 1886, the Directors only held between them 175 shares; in 1890, 202; and at the present time, 258. It took 50 shares to qualify as a Director; so that in 1886, they only held 25 shares above the number specified. And these gentlemen, who only held this number of shares, and received £1000 a year for their services, issued on the present occasion a balance-sheet which was disastrous to the Company. The dividend ought not to have been withheld; for the very object of the reserve fund was to meet such contingencies as this. He concluded by moving, as an amendment, that a Committee of Investigation be appointed, on the ground that he believed there was "something rotten in the state of Denmark."

Mr. ROBINS seconded the amendment.

Mr. BATTEN, referring to the new issue of shares, said he was a lawyer, and did not know much about figures; but he should like each shareholder to work out this little sum—"How much better off should I have been now, if I had had to pay £17 apiece for these shares?" He also spoke of Mr. Fox's long experience at San Paulo.

Mr. W. CASH, the Auditor, in alluding to the reserve account, remarked that it was a matter of opinion whether it was wor thwhile locking it up in (say) English railway stock at 3½ per cent., while it could be employed more profitably in their own business.

Mr. J. R. TYNDALE inquired whether the Chairman would have any objection to a Committee of Inquiry.

The CHAIRMAN replied that he should take it as a personal reflection, after his 20 years' service to the Company. Only at the last meeting the shareholders passed a resolution acknowledging the faithful way in which he had discharged his duties; and now to talk about an investigation reflected upon his honesty.

Mr. R. FROST-SMITH considered the Directors were entitled to the sympathy of the shareholders, for the circumstances which had brought about the present position were entirely beyond their control.

After further discussion,

Mr. Batten, and two or three of the shareholders, appealed to Mr. Fowler to withdraw his amendment, which he did after his seconder had stated that he could no longer support it.

The original motion was then unanimously carried.

The retiring Directors (Messrs. Fox and Hillier) and the Auditor (Mr. Cash) were re-elected.

On the motion of Mr. TYNDALE, seconded by Colonel ROBINSON, a vote of thanks was passed to the Chairman and Directors.

The proceedings then terminated.

SINGAPORE GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Thursday, at the Cannon Street Hotel—Mr. R. S. FOREMAN in the chair.

The SECRETARY (Mr. R. M. Christie) having read the notice convening the meeting, the report of the Directors was taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, stated that the position of the Company's affairs during the past year had caused the Directors very considerable anxiety, and also, as he was fully aware, the shareholders great disappointment, inasmuch as they had been asked to forego their customary dividends, and consent to have the profit made from the Company's working during that period applied in reduction (within reasonable trade compass), of the outstanding indebtedness of the Company, caused by the large expenditure which had been required from want of working capital for extension of mains, the construction of an additional gasholder and tank, and for other expenditure, by far the greater portion of which was really properly chargeable to capital, but which of late was not available from that source. The Directors had taken the present opportunity of writing off several items (which he proceeded to specify) that had hitherto appeared on the credit side of the balance-sheet. The various writings-off amounted together to upwards of £1800. They had also placed to depreciation account £750. This and other charges left an available balance of £685 to the credit of the profit and loss account; and this the Directors proposed to carry forward. With regard to their Managers, Mr. Batten, as the shareholders were probably aware, had been eight years in the service of the Company. When he took over the charge of the works, he found them in a very disorganized state. The buildings were much out of order; and the mains had also been greatly neglected. From the time, therefore, of his taking office almost up to the present, he had had to spend considerable sums in order to put the works, plant, and machinery into a thoroughly efficient condition. During his tenure of office, the sum of £5446 had been expended on repairs to buildings, plant, and machinery. In the ten years previously, when Mr. Wells had the management, the expenditure was *nil*. There was not a single item during these ten years charged to the debit of profit and loss account; and therefore Mr. Batten had, in this respect, been very much handicapped. The expenditure for the extension of mains and the new gasholder and tank in the eight years had been £22,800; and as the increase of capital in the same time had been only about £10,000, the revenue had been very heavily charged. The principal works undertaken by Mr. Batten were the erection of a new river wall, which involved considerable cost, to enable him to cope with the periodical recurrence of floods; he had also put up an extensive range of buildings for coal-stores, and had further superintended the erection of a new gasholder and tank, besides carrying out various other improvements, which it was not necessary for him (the Chairman) to further particularize. During his residence at Singapore, Mr. Batten had, as their Manager, proved himself a *persona grata* to the authorities; and he left the Company's service with the goodwill and respect of all with whom he had come into contact. With regard to his successor, Mr. H. W. Smith (late Secretary and Manager of the Caterham and Kenley Gas Company) was known to most of the shareholders, from his constant attendance for many years at their meetings. For the past two years he had been a Director of the Company, and now came to them with very good credentials from his late employers. They believed that Mr. Smith knew the affairs of the Company thoroughly, and that he would prove a most efficient and economical Manager. They received last Monday a letter from him, which he would ask the Secretary to read.

The SECRETARY read the letter, in which reference was made to Mr. Batten's good relations with the authorities; the writer adding that he would endeavour to maintain those relations. He had only made a cursory examination of the works and plant; but, so far, he was satisfied with their condition, and they more than fulfilled his expectations—nothing appearing to be wanting in the way of substantial repairs. He had gone over some portion of the district, which was extensive, and the business part of Singapore had agreeably surprised him. Taken as a whole, he was satisfied with the position of the Company there. The public lighting was done very well, and was equal to that of the City of London.

The CHAIRMAN (resuming) said he had only again to express the Directors' regret that they had no dividend to recommend for the past year. The next account would, however, show a clean balance-sheet. There would be no more writings-off, and whatever balance there was for appropriation would all be divisible among the shareholders. The Directors hoped and confidently expected that they could conduct the business of the Company without any further application to the shareholders for an extension of working capital; and he honestly believed that the Company was now in a better position than it ever had been previously.

The DEPUTY-CHAIRMAN (Mr. S. Spencer), in seconding the motion, observed that the new departure, as he might call it, which had been brought about by the Directors was a very good thing to have established. The Company had been in existence about 30 years; and he believed that this was only the third time that the shareholders had gone without a dividend. He thought this was a wonderful record.

Mr. DEAN criticized the position of the Company, and said he did not see how they had much to congratulate themselves upon, seeing that the shareholders were to get no dividend; and he maintained that the reserve fund—£867—was no reserve at all, being invested in the business of the Company.

The CHAIRMAN having replied, the motion was put and adopted.

Mr. A. E. Stephenson and Mr. B. Green were then re-elected as Directors; and Mr. Magnus Ohren as Auditor, in the place of Mr. C. Newton, deceased. Mr. T. Guyatt was also appointed Auditor in the place of Mr. B. Green, resigned.

The CHAIRMAN next moved a vote of thanks to the former Manager, Mr. W. T. Batten. He remarked that he had already expressed his opinion of the valuable services performed by that officer, and therefore need not make any further comment thereon.

The motion having been carried unanimously,

The CHAIRMAN proposed a vote of thanks to the Secretary, who, he said, had undertaken the duties at a very arduous time, in consequence of the sudden death of Mr. Robert King; and he must say had fulfilled those duties to the entire satisfaction of the Directors.

A unanimous vote of thanks was then passed to the Chairman and Directors for their services; and the proceedings closed.

MONTE VIDEO WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at Winchester House, Old Broad Street, E.C.—Mr. F. S. ISAAC in the chair.

The SECRETARY (Mr. J. Anderson) read the notice calling the meeting, and the report of the Directors, to which reference has already been made in the JOURNAL, was taken as read.

The CHAIRMAN, in moving the adoption of the report, observed that the Company had encountered very bad times in the River Plate during the past year; and it was therefore with great satisfaction that he could meet the proprietors without having any bad news to report. The accounts showed a result far from unsatisfactory—a similar dividend to that which was paid last year had been earned. He might safely assert that no other company connected with the River Plate had been able to exhibit such a healthy report as the Directors had done. There had been a decrease of £7654 in the revenue; but this was owing entirely to the reduced subvention-money of which they had been in receipt from the Government. The ordinary income, therefore, had been entirely maintained. The expenditure had decreased by £2213, principally due to the saving they had been able to make in coal, and also to economies effected in labour employed in the working of the filters. Since the introduction of the purifying machinery, the expenses had increased; but the results from the process had been highly successful, and had, he believed, tended to an augmentation of the business, and also to a decrease—he might say to almost a cessation—of complaints from the consumers about the water. The special reserve fund, which now amounted to £60,000, had been accumulated out of the Government subvention in past years; and this fund as well as the reserve for the renewal of buildings and plant, amounting to £12,258, was sunk in the business; and the investment in the extension of mains and other large works had proved remunerative. The present time was not favourable for raising new capital; but if, in the future, an opportunity presented itself, the attention of the Board would be called to the advisability of making a fresh issue—at all events, of a sum sufficient to pay off the loans and, in addition, to have an amount of available cash to meet any emergency. The business was in a sound condition. The term of the original concession expired in March of last year; and the subvention-money died with it. They were now working under an arrangement with the Government, the terms of which, with the exception of the reduced subvention, were similar to those of the original concession. At a convenient moment, the agreement would be brought before Congress for approval. The authorities had punctually paid the Company the subvention agreed upon; and they met them in a friendly spirit when matters arose in which their interests were concerned. He thought they owed this position to the determination of the Directors to leave no effort untried for perfecting the quality and condition of the water supplied. To attain this object, they had spent a vast amount of money, which the shareholders might have received in dividends; and he believed it was the liberal policy adopted by the Company which had won the confidence of the people. The works were now pretty well complete; and no material amount of capital expenditure would be necessary for a considerable time. In regard to the current year, the letters received went to the end of March; and up to that date the working was in all respects satisfactory. He concluded by warmly acknowledging the services of Mr. Galwey, the Manager, and those of the Secretary.

Mr. W. A. JONES seconded the motion, which was unanimously adopted.

On the motion of the CHAIRMAN, seconded by Mr. J. H. DUNCAN, a resolution was passed, declaring a further dividend of 2½ per cent.; making 5 per cent. for the year, tax free; leaving £2256 to be carried forward.

Votes of thanks were passed to the Manager and staff, and also to the Chairman and Directors, and the proceedings then closed.

The Gas Question at Eccles.—At the annual meeting of the members of the Barton, Eccles, Winton, and Monton Local Board on Monday evening last week, the Clerk reported that he had received from Sir C. L. Peel, Secretary to the Privy Council, the draft scheme for the incorporation of the district; and as no notice of opposition had been given, he took it that in the course of next month the Charter would be received. Mr. Parr moved that a Committee be appointed to approach the Salford Corporation, with the view of ascertaining what terms they were prepared to offer Eccles in the future in the matter of gas supply. He pointed out that if the new Town Council intended to proceed with a Bill in November next to make their own gas, the preliminary steps would have to be taken by the Local Board, who were, now they had dropped Swinton, in a much better position to demand terms from Salford than previously. Mr. Barlow seconded the motion. Mr. Hill said he was satisfied that Salford, if it did not totally abolish the differential rate, would reduce the present charge by 2d. per 1000 cubic feet. Mr. Heath said he would not only ask for the abolition of the differential rate, but a share of the profits made out of the consumption of gas in the out-districts. Mr. Stocks said the Board had no official evidence that Salford would now abolish the differential rate. As the Board had obtained the right to proceed with a Bill, he objected to going to Salford to ask for further concessions. Mr. Spary held that not only had Salford refused to abolish the differential rate, but it would refuse to allow Eccles to participate in the profits made out of the consumption of gas in its district. After further discussion, the motion was carried; and a Committee was appointed to wait upon the Corporation.

THE PUBLIC LIGHTING OF THE CITY OF LONDON.

Report by Mr. W. Haywood, M.Inst.C.E.

The Engineer and Surveyor to the Commissioners of Sewers of the City of London (Mr. W. Haywood, M.Inst.C.E.) has presented a report on the works executed by that body during the past year. Referring to street lighting, he states that tenders were received from The Gaslight and Coke Company for lighting the public lamps with gas for twelve months from Jan. 1, 1891; the price charged being 2s. 2d. per 1000 cubic feet of gas consumed. The following are details of the tender: Square lanterns, furnished with burners consuming 5 cubic feet of gas per hour, and in use for 4300 hours per annum, £3 4s. 7d. per lamp; being £2 6s. 7d. for gas, 15s. for lighting, and 3s. for repairing. Circular lanterns (similar conditions), £3 8s. 10d.; being an additional charge of 4s. 3d. for extra trouble in cleaning and repairing. Square lanterns, furnished with burners consuming 10 cubic feet of gas per hour (number of hours as with other lamps), £5 11s. 2d. each; being £4 13s. 2d. for gas, and the remainder for lighting and repairing. Circular lanterns, £5 15s. 5d. each; the additional charge being for cleaning and maintenance. The number of defective lights observed during the year was 665, as compared with 685 in 1890. These returns are made to the Commissioners daily by the City Police, and include only those lamps in which defective lighting is very noticeable. Although the number is less than last year, Mr. Haywood says it is above the average of former years, and may be accounted for by the severe weather prevailing during the early months. The 36 meters attached to the public lamps in various parts of the City show that the full contract quantity of gas is given at those lamps. The Inspector of Gas Lighting, as well as the Inspectors of Pavements, are of opinion that the regulators of the lamps generally are kept in proper condition, and that the full quantity of gas contracted for is furnished by the Company at all the public lamps. Owing to the inconvenience to the traffic caused by the fogs, the Company, acting upon the instructions they have had for many years past to light the public lamps when fog or darkness ensues, lighted the gas-lamps during the daytime on 20 different occasions. The experimental lighting by gas of Cheapside, the Poultry, and other important thoroughfares, comprising 112 lamps in all, with burners varying in consumption from 8 to 17 cubic feet of gas per hour, was continued throughout the year, at the expense of the Company; and the results in lighting the streets sufficiently are acknowledged by Mr. Haywood to be very satisfactory. The lamps in Queen Victoria Street were, for the most part, discontinued in the month of September, when the City of London Electric Lighting Company undertook to light that thoroughfare by electricity; and the same may be said of the lamps of Cornhill and King William Street, which were lighted by the same means on Jan. 6 of the present year.

With regard to electric lighting, the report states that, in the year 1890, contracts had been assigned to the Brush Electrical Engineering Company, for lighting the central and western districts of the City; and to the Laing, Wharton, and Down Construction Syndicate, for lighting the eastern district. In January, 1891, the Commissioners were asked to give their sanction to the placing of an electric main junction box beneath the public way on the west side of the Mansion House, so that the inauguration of the work for the electric lighting in the City might take place at the end of the following month. This application was agreed to; and, on the day named, the inauguration ceremony took place. The Lord Mayor, together with the Directors and officials of the two Electric Lighting Companies, laid the memorial or foundation stone of the first junction box for the electric lighting works of the City. On the 13th of January, the Brush Electrical Engineering Company gave notice of their intention to commence their works in Queen Victoria Street; and up to the end of the year, they had laid ther conductors in Queen Victoria Street (subways), Cannon Street, St. Paul's Churchyard, Queen Street, Walbrook, and Mansion House Place. They also fixed 25 lamp columns and lamps in Queen Victoria Street, which were experimentally lighted on and after the 17th of June last; but the ordinary gas-lamps were kept alight nightly until the 21st of September, when the largest portion of them were discontinued. Since then the street has been lighted mainly by electricity. On the 17th of January, the Laing, Wharton, and Down Construction Syndicate gave the statutory notice to commence their work in the first section of the east district, under their Provisional Order. Up to the end of the year, this Company had laid their conductors in Lower Thames Street, Arthur Street East (subways), King William Street, Cornhill, Gracechurch Street, and Lombard Street. They also erected 25 lamps and columns, and temporarily lighted King William Street, Gracechurch Street, and part of Cornhill. On Jan. 6 of this year, they lighted permanently the thoroughfares named; the largest portion of the public gas-lamps have not been used since that date. On May 26, letters from the two Companies, with copies of communications addressed to the Board of Trade, were laid before the Commissioners, relative to the transfer of their undertakings to a new Company about to be formed, under the title of the City of London Electric Lighting Company, and asking the approval of the Commission thereto. These communications were referred to the Streets Committee, who, on the 23rd of June, reported relative to the proposed transfer, and recommended that it should be signified to the Board of Trade that the Commissioners saw no objection thereto, provided the due constitution of the new Company and the subscription of the capital should be evidenced to the satisfaction of the Board of Trade and the Commission; also, that a similar reply be given to the undertakers, with the addition that the rights of the Commission under the respective contracts were to be maintained intact. Amendments were moved to this report, to the effect that the Commissioners were unable to approve of the proposed transfer; and that, in the interest of consumers in reference to the operation of the sliding-scale clause, they should strongly object to any amount being paid to the contractors as purchase-money for their agreements with the Commission. These amendments were not carried, and the report of the Streets Committee was agreed to by the Commissioners on the 23rd of June; and the undertakings were transferred on the 21st of August. On the 17th of November, a letter was laid before the Commission, in which the new Company applied for an extension of the period named in the contracts between the Commission and the two original Companies for carrying out the public lighting of the City. This letter referred to all the work that had been previously done by the Companies; and after reciting the time which had been lost in assigning and taking over the contracts, and the fact that they had already expended large sums of money on the freehold and leasehold sites for generating stations in Southwark and Lower Thames Street, it stated that they trusted the Commission would see that no time had been lost, and would grant an extension of at least one year. At a subsequent meeting of the Commissioners on the 1st of December, this letter was fully considered, together with another explanatory of the exact position of the Company at that date; and the Commission then resolved that the terms of the existing contracts must be adhered to. The Company thereupon vigorously pushed on the work during the month of December; and during the present year, and up to the date of the report (April 5), Mr. Haywood says they have been actively engaged in carrying it forward in both the central and the east districts of the City, but mainly in the former.

GAS AND GAS-METER TESTING IN MASSACHUSETTS.

We have been favoured by Mr. C. W. Hinman, the Inspector of Gas and Gas-Meters for Massachusetts, with a copy of the report presented by him to the State Legislature on the work of his Department in the past year. The following particulars are extracted therefrom.

Dealing first with the testing of gas (although this comes last in the report), we find that the law requires that at least two inspections a year should be made of the gas of every company supplying more than 50 consumers. One additional inspection is to be made for every 6 million cubic feet of gas sold; but the gas of no company is to be inspected oftener than once a week. There are 68 companies in the State whose gas requires inspection; the number of inspections varying from two per annum for the smallest, to 52 per annum for the largest company. Each inspection usually comprises a determination of the illuminating value, the presence or absence of sulphuretted hydrogen, and the amount of sulphur and ammonia in the gas. Additional determinations are sometimes made—such as the specific gravity of the gas and the eudiometric analysis. The law requires the larger companies to maintain stationary photometers at some distance from their works; and they were used for testing the gas supplied by these companies. The gas of the smaller companies was tested by means of a portable photometer. The tests of the gas of the former companies were usually made at the companies' offices. The gas of the latter companies was tested at hotels and town halls, as well as at the offices. The inspections were made at rather irregular intervals; and no notice was ever given when they were to take place. More inspections were made in the winter than during the summer, so as to follow the production of gas to a certain extent. The average illuminating power of the gas supplied by the larger companies (24 in number) was 18·41 candles; that of the gas sent out by the 34 smaller companies being 17·99 candles. There are ten companies making petroleum gas; the average light-giving power being 33·61 candles. With regard to impurity, the percentage of sulphur and ammonia in the gas of the larger companies was 9·85 and 3·88 grains respectively; in that of the smaller companies, 9·31 and 3·09 grains. The companies may be divided into two classes—viz., those who use water gas, and those who do not. Of the larger companies, those at Boston, Charlestown, Dorchester, Fall River, Haverhill, Lawrence, Lynn, New Bedford, Roxbury, and Worcester sell more or less water gas. Leaving out of account Charlestown, Haverhill, and New Bedford, who made only a comparatively small quantity of water gas, the other seven companies show an average increase in the illuminating value of their gas of 1·5 candles over the results of the previous year. The remainder of the larger companies manufactured coal gas, which in some cases was enriched with oil gas. The gas of these companies showed, on the average, the same candle power as the previous year. The gas of the smaller companies averaged one-third of a candle higher than the average of the same gases for the preceding year. The gas at Charlestown was on one inspection found to be below the legal minimum of 15 candles. Those small companies who manufacture a rich petroleum gas, to which they usually add some air to prevent smoky flames, have, on the average, decidedly decreased their candle power, as compared with the gas furnished by the same companies during the year 1890. If, however, the comparison is made with the gas supplied previous to 1890, there is no decrease in candle power shown. On an average, the gas contained a little less sulphur last year than in 1890. The legal maximum is 20 grains per 100 cubic feet. Sulphuretted hydrogen was found on twelve occasions. The average amount of ammonia was greater in 1891 than in several previous years. The Inspector thinks there is no good reason for this excess, as an increasing quantity of water gas, which does not contain this impurity, is manufactured.

After having given the results of his eudiometric analyses of the gas of certain companies, Mr. Hinman proceeds to refer to an apparatus he has devised for quickly and accurately testing gas. His remarks on this matter are as follows: There has been for some years a demand by gas superintendents for an apparatus for gas analysis that could be worked quickly, and still give results accurate enough for practical purposes. The apparatus used for the scientific analysis of gas, and which demand only a moderate amount of time for their use, are fragile, expensive, and are only fit to be used by professional chemists. They all use mercury as a seal. There have been several appliances devised which, by using water as a seal, and neglecting corrections for changes of pressure and temperature, have enabled results to be obtained with ease and rapidity. There has been some question as to the accuracy of the results obtained by this quick-working apparatus; some claiming that they were practically as accurate as any other style of apparatus. I have endeavoured to throw some light on this question by making some comparative analyses of the same gas with both styles of apparatus. The mercurial apparatus used resembles, in some respects, that of Williamson and Russell, and in others that of Doyere. For the apparatus using water as a seal, I have used that of Hempel, as I considered it one of the best of its class, and it is considerably employed by gas engineers. Two different gases were analyzed with each apparatus. The first was a mixture of coal gas and water gas,

with the addition of some carbonic acid and air. This was analyzed repeatedly with Hempel's apparatus, and according to his latest directions. The results were comparatively easy to obtain, and required not much more than an hour's time, if the absorptions and drainings were not too prolonged. The following is an outline of the operations: Carbonic acid was absorbed by caustic potash; the illuminants, by fuming sulphuric acid followed by caustic potash; the oxygen, by phosphorus; and the carbonic oxide, by cuprous chloride dissolved in muriatic acid. A part of the residual gas was mixed with an excess of air and exploded over mercury, and the carbonic acid formed absorbed by caustic potash. The data obtained allow of the calculation of the amounts of marsh gas, hydrogen, and nitrogen. The gas was contained in a glass sealed with mercury, and was analyzed as opportunity offered on four different days. The following results were obtained:—

Carbonic Acid.	Illuminants.	Oxygen.	Carbonic Oxide.	Marsh Gas.	Hydrogen.	Nitrogen.	—
6·33	11·74	1·11	22·70	19·03	32·16	6·93	3rd day.
6·00	11·00	..	21·60	20·50	29·20	11·70	
—	—	—	—	21·30	28·40	11·70	
—	—	—	—	20·50	31·20	9·70	
6·00	11·40	..	21·70	20·20	32·40	8·30	1st day.
—	—	—	—	20·60	31·60	8·70	
—	—	—	—	19·80	31·90	9·20	
5·80	11·20	..	21·60	19·60	33·40	8·40	
5·90	11·60	1·20	20·70	20·50	30·10	10·00	
—	—	—	—	20·10	30·90	9·60	
—	—	—	—	19·80	31·10	9·70	
—	—	—	—	20·30	30·30	10·00	2nd day.
5·70	11·80	1·30	20·70	20·20	30·30	10·00	
—	—	—	—	20·20	30·60	9·70	
6·30	11·60	1·90	21·20	20·00	28·20	10·80	
—	—	—	—	20·30	27·90	10·80	4th day.
—	—	—	—	17·80	37·30	5·40	

The first result was obtained by the use of the mercurial apparatus; he others with Hempel's. The results obtained by direct absorption show a satisfactory agreement between those given by the two styles of apparatus. In three of the analyses, the failure to find oxygen was due to the use of phosphors which had been too long exposed to the light. The smaller amount of carbonic oxide found with Hempel's apparatus was probably due to the use of only one pipette of cuprous chloride, as Hempel recommends two. In the results obtained by explosion in Hempel's apparatus, the hydrogen was usually from 1 to 4 per cent. too low, and the nitrogen from 3 to 4 per cent. too high; the results of the mercurial apparatus being taken as the standard. The last explosion in the table was made over water; and the results are seen to be still less reliable than those over mercury. The coal gas next selected was still more difficult of analysis by the Hempel apparatus, as much less of the work depended on absorption, and much more on explosion, than with the first gas. Two analyses of this gas by the use of the mercurial apparatus are given—Nos. 7 and 8. They are independent analyses, except that a reading was accidentally omitted in one, and was supplied from the other. This substitution only affects the marsh gas and the carbonic oxide. Three other analyses—Nos. 9, 10, and 11—of a similar gas, made some years ago, are given to show the accuracy of the apparatus. These are the only strictly duplicate analyses I have ever made with the apparatus in its present state. This gas was analyzed by Hempel's apparatus, and by the same methods as was the first gas. In this case only one-sixth of the residual gas from the absorptions could be exploded at once, as it contained so much marsh gas. In consequence of this, any error in this part of the analysis was multiplied by six in converting the results into percentages.

—	Carbonic Acid.	Illuminants.	Oxygen.	Carbonic Oxide.	Marsh Gas.	Hydrogen.	Nitrogen.
1 . . .	·40	4·70	..	5·60	39·90	40·70	8·70
2 . . .	·00	4·50	·10	5·30	39·10	42·40	8·60
3 . . .	·10	4·90	·20	5·80	37·80	42·80	8·40
4 . . .	·20	5·10	·20	5·50	38·90	48·70	1·40
5 . . .	—	—	—	—	—	47·80	2·30
6 . . .	—	—	—	—	—	49·00	1·10
7 . . .	·09	4·89	·06	8·47	37·59	48·10	0·80
8 . . .	·10	4·89	·07	8·33	37·66	48·29	0·66
9 . . .	·10	5·59	..	6·91	36·84	49·90	0·66
10 . . .	·10	5·65	..	6·97	36·74	49·93	0·61
11 . . .	·10	5·70	..	6·75	36·85	49·89	0·71

These results show, as did the previous ones, that the apparatus is reliable for absorptions; but they emphasize the need for a second pipette for absorbing carbonic oxide. Each portion of residual gas left from the absorptions was exploded in four or five separate portions, and the average results are given in the first three analyses. The variations in the results of the separate explosions of the same residual were from 2 to 10 per cent. on the whole amount of gas taken. The average results for hydrogen were 6 per cent. too low; and the nitrogen was as much too high. Variations were made in the pressure at the time of explosion, and also in the amount of air used; but no increase of accuracy was obtained. Of course, such results are of no use to anyone. As the results obtained by this method were found to be so absolutely useless, another method of Hempel's was tried. It consisted in mixing a part of the residue from the absorptions with a sufficient quantity of air, and passing the mixture over palladium sponge. Only the hydrogen burned; and its amount was calculated from the contraction. Another portion of the residue was then mixed with air, then exploded over mercury, and the carbonic acid formed absorbed by caustic potash—its amount giving the quantity of marsh gas. The nitrogen was found by subtracting the volume of all the gases determined from the quantity of gas taken. Analyses Nos. 4, 5, and 6 were made by this method. The quantity of marsh gas given is the average result of all the explosions. If due care is taken, and not less than three explosions are made (the results being averaged), this last method gives results within about 2 per cent. of the truth. Unfortunately, this method of using the apparatus takes as much time as would be occupied in making an analysis with the mercurial apparatus.

In Mr. Hinman's report for 1890, a full abstract of which appeared in the JOURNAL for April 7, 1891 (p. 655), reasons were given, at some length, for the exclusive use of open burners for testing gas. During the past year, the Company with whose gas the greatest difference between the results of testing with open and Argand burners respectively was found, ceased to supply illuminating gas. The gas of none of the other companies showed nearly as great differences when tested with the two kinds of burners as did that of this Company. These facts, the Inspector thinks, make the need of an alteration in the law less necessary than it was in previous years, although the reasons for a change still remain. He is of opinion that, if the existing conditions are retained, the present minimum for illuminating power should be raised from 15 to 16 candles.

Turning now to the first part of the report, which furnishes particulars as to the testing of meters, we find that during the past year 16,585 meters were inspected, of which number 16,354 were either new or repaired. There were 231 meters which had previously been in use brought to the Inspector's office and complained of as incorrect; the complaints coming mostly from gas consumers. On reinspection, 54 of these meters were found to be too fast—11 being more than 5 per cent., and one as much as 14 per cent. too fast; the average error being 4·74 per cent. There were 144 meters found within the legal limits—viz., 2 per cent. either way; 34 were found to be too slow—9 being more than 10 per cent., and one as much as 50 per cent. slow. The average error was 10·03 per cent. One meter did not register. The average error of the meters complained of that registered was 0·41 per cent. slow. Nearly all these were dry meters. Taking the results of the tests of meters complained of during the past 20 years, a gradnal improvement in accuracy is shown—not so much by the average error from year to year, as by the increased proportion of correct meters. During the first five years of the period under consideration, only 44 per cent. of the meters complained of were correct; in the middle ten years, about 50 per cent. of them were correct; and in the last five years, 64 per cent. The Inspector remarks that these meters can scarcely be taken as a fair average of those in use throughout the State, as they were suspected and complained of as incorrect either by the consumers or the gas company. Comparatively few meters are complained of and taken to the office for inspection by the companies; for when they suppose a meter to be incorrect, they generally remove it, and test it for themselves. As consumers are not apt to intentionally complain of slow meters, it follows that those taken to the Inspector on account of complaints, are faster than the average of the meters in use.

EXHIBITIONS OF GAS APPLIANCES.

Last Tuesday, an exhibition of gas cooking and heating appliances, promoted by the Smethwick Local Board, and effectively carried out by the Gas Committee, was opened in the Public Hall in that town by Mr. Jabez Lones, and continued during the week. The exhibits were manufactured by Messrs. W. Parkinson and Co.; and their qualities were well displayed by Miss Woods in a series of cookery lectures and demonstrations, which were well attended. The same firm have a stand at the Trade and Industrial Exhibition now being held at the Bingley Hall, Birmingham; and this week they are holding an exhibition in the Drill Hall, Nuneaton—lectures on cookery be ingdelivered in the afternoon and evening by Miss Woods. The Davis Gas-Stove Company, Limited, were busily engaged all last week in holding in various towns exhibitions of their well-known appliances. At Bedford they were assisted by Mrs. Wilkinson; at Bristol, by Miss E. Johnston; at Felixstowe, by Miss M. A. Rotherham; at High Wycombe, by Miss J. Cameron; at Stoke-upon-Trent, by Mr. W. J. Young, M.P.S. The whole series of exhibitions and lectures was held under the auspices of the Gas Companies in the respective towns. The Alliance and Dublin Consumers' Gas Company held an exhibition of gas appliances last week in the annex adjoining the Leinster Hall, Dublin. The premises, we learn, were most admirably laid out; and nothing could possibly have been better than the way in which the appliances were displayed. Lectures were delivered each day, except Saturday, in a specially erected theatre. During the past week an exhibition of gas appliances was held at the Town Hall, Wells, under the auspices of the Wells Gaslight Company; able lectures being delivered twice daily by Miss E. Golding, of London. The gas ranges, fires, and other contrivances for cooking and heating, supplied solely by Messrs. Richmond and Co., Limited, of Warrington, made a large and most effective display. The matter was energetically taken up by the Company, through their Secretary and Manager (Mr. C. V. Bennett), and on behalf of Messrs. Richmond and Co. by Mr. Arthur Mead, their representative for the district; and there were large attendances. Mr. E. W. T. Richmond gave an interesting extempore lecture on "Gas as a Domestic Servant." In the enforced absence of the Mayor, Mr. E. Hippisley, the Chairman of the Gas Company, opened the exhibition. At Crewkerne, last Tuesday, under the auspices of the Gas Company, Messrs. Darwin and Co., of Glasgow and London, made a successful display of their cooking and heating appliances. The exhibition was opened by the Chairman of the Company (Mr. G. F. Wills); and lectures were delivered by Miss Phillips twice daily during its continuance till Friday. A gas exhibition, held under the auspices of the Rossendale Union Gas Company, was opened at Bacup by the Mayor (Mr. H. Salmon) on Monday last week. The chief exhibitors were Messrs. Richmond and Co., Limited, of Warrington and London (who showed a special cooker suitable for mill hands), Messrs. C. Wilson and Sons, of Leeds; and Messrs. J. Wright and Company, Limited, of Birmingham. Lectures were given by Miss Haxworth, of Liverpool. At Ramsay (Isle of Man), the same firm held an exhibition from the 19th to the 22nd ult., to inaugurate the adoption, by the Ramsay Gas Company, of the system of letting out gas-stoves on hire. The arrangements were carried out by Mr. J. Cannell, the Company's Secretary; and the exhibition was opened by the High Bailiff. Lectures were given by Miss Owen, of London.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. J. M'Gilchrist's Committee of the North British Association of Gas Managers have commissioned Mr. D. W. Stevenson, R.S.A., Edinburgh, a rising Scottish sculptor, to execute the bust of William Murdoch, which is to be placed in the Wallace Monument at Stirling on the occasion of the annual meeting of the North British Association. At the Edinburgh meeting last July, it was agreed that the meeting this year should be held in Dundee; and that on the second day the members should journey to Stirling to conduct the ceremony in the Wallace Monument. The unfitness of the arrangement was observed by some at the time. The Committee of the Association are fully convinced of its awkwardness; and they have issued a circular to the members asking if they will consent to the holding of the meeting this year in Stirling. It will require an almost unanimous vote of the members to upset the resolution of the last meeting; but there should be little difficulty in securing this for a proposal which has so much to recommend it.

The Edinburgh and Leith Gas Commissioners held a short and uninteresting meeting last week—not, I presume, because there was nothing for them to do, or to speak about, but because it did not suit them to make much ado in the meantime. Their most important business was the Engineers' reports for March, which are a puzzle to me. The total output of gas from both works was 106,598,000 cubic feet, which was a decrease of 5,958,000 cubic feet over the output in March of last year. There was an increase of 1,387,000 cubic feet from the Edinburgh works, but a decrease of 7,345,000 cubic feet from the Leith works; though during the month of February there was a decrease in the output from Edinburgh, and an increase in the output from Leith. How the two districts should play fast and loose in this manner, I cannot understand; and I am led to believe it is a puzzle to others as well as to myself. The yield of gas from the Edinburgh works was 10,005 cubic feet of 26·01-candle gas per ton of coal; and from Leith, 10,159 cubic feet of 26·49-candle gas per ton. The Commissioners have set their face against giving assistance to makers of gas-stoves to exhibit their appliances. Within the past two months four firms have applied for permission to get up gas exhibitions; but all have been declined. At the present high price of gas, it is more than probable that an exhibition of gas appliances would do neither the Commissioners nor the exhibitors much good. One effect which it would really have would be to give rise to comparisons with other places, to the disadvantage of the Commissioners. They are probably, therefore, wise, so long as there is no great demand for gas-stoves, to keep as quiet on the subject as possible. An ominous instruction was given for an enquiry into "the increased amount of unaccounted-for gas during the current year," which was probably the occasion of the remark by Mr. Wells that he should point out, later on, that "very little reliance could be put upon the Engineers' reports." He did not enter further into the subject; and therefore the revelation of what Mr. Wells has got under his thumb must be looked for another time. That is a plum in store. A matter which was before the Commissioners—small in amount, but perhaps important in principle—was the rate of pay to the collectors of gas-rental. This was brought up upon a motion proposing a return to the system of pay which prevailed before the transfer; and the notion underlying the proposal was that the Commissioners were too liberal to their collectors during sickness, which encouraged malingering among them. Mr. Cockburn, the collector, had a memorandum prepared, which showed that the cost of collection by these men was at the rate of 1·98d. under the Edinburgh Company, and 2·07d. under the Commissioners—representing an increase of about £70 a year to the Commissioners. Considering the enlargement of the business since the transfer in 1888, this was not out of the way; and the Commissioners refused to take any action in the matter. The Commissioners had also before them the common stair-lighting question; but nothing new transpired upon it, except the hope, expressed by a Special Committee which had considered it, that "by next winter the town will have made proper arrangements for the lighting of these stairs." What they meant by "proper arrangements," I take to be that the town shall have arranged to do the work.

The latest attempted sensation in connection with the gas supply of Edinburgh, is contained in a paragraph to which the *Scotsman* to-day gives the premier place, the statement in which is to the effect that the Gas Commissioners, who have been in the habit of employing a staff of bricklayers for the repairing of retort benches, paying them 8d. per hour, have begun to give the work to a master builder, who will probably charge the Commissioners 1s. to 1s. 3d. per man per hour. It is also added that one of the old bricklayers, a man who has been employed in the works for over ten years, on applying to have his wages raised to 9d. per hour, was refused, and was afterwards turned out of the works without a moment's notice. The story is published, the *Scotsman* says, in order that the authorities may have an opportunity of contradicting or explaining it; but that this is not the only object, is shown by the concluding sentence, which is as follows: "If this be a sample of how affairs are conducted in the gas-works, there is little wonder the price of gas is increasing." The story has every appearance of being a very one-sided one. I have a suspicion that it is directed, not against the management of the works, but against the builder; but to write more about the matter would be an anticipation of whatever explanation may be made by the Commissioners or the officials in the works.

A cheering piece of news comes from Dundee, to the effect that the Gas Commission have received about seventy offers to supply coal during the next financial year, which is double the number received when the Commission was in the market a year ago. In reporting the circumstance to the Works Committee on Monday, ex-Provost Brownlee said he believed the prices would be found to be much lower than are at present being paid. The Finance Committee, on the same day, were informed that for the eleven months ending on March 31, the gas-rental had amounted to £68,324, which is £4687 above the sum at the corresponding date last year; and this increase has taken place notwithstanding that several large installations of electric lighting have been in existence. Already the members of the Finance Committee are beginning to forecast their schemes for next year. It seems they were prepared to face an increase in the price of gas, to make up for the loss of revenue arising from the fall in the prices obtained for residual products. The lower prices at which coal is being offered, however, they anticipate, will enable them to go on at least at the same rate as at present—3s. 8d. per 1000 cubic feet—and probably they will be able to make a reduction.

Another item of information which was communicated to the Finance Committee, was that four of the annuities of the Commission, amounting to £76 10s., had been purchased for £2315 5s. 2d., which is at the rate of about 30 years' purchase. It is slow work redeeming annuities; but the Dundee Gas Commission keep pegging away at the task, and in course of time, though it is probably a long way off, the undertaking will get rid of them altogether.

There was a slight ruffle on the bosom of the usually placid surface of the big ocean of Glasgow on Tuesday, when the Finance Committee of the Police Board met to consider 106 appeals by owners of property in private streets in the recently amalgamated burghs, against the imposition of a special tax upon them in respect of the cleaning and lighting of their thoroughfares. The cases from Hillhead were the only ones which were argued. It seems that the former Police Commissioners of the burgh were in the habit of requiring the owners of property to provide the street lamps; and that then they undertook the lighting. The Glasgow Police Act does not allow this. The owners of property where the thoroughfares have not been put on the burgh register, are required to maintain and clean them, and to pay also for the lighting. On behalf of the proprietors, it was argued that in taking over the whole burgh, the city of Glasgow also took over the obligations of the former Police Commissioners. Mr. Colquhoun, the Chairman of the Committee, however, pointed out that there was no obligation on the part of the former Police Commissioners to light the thoroughfares, but that they did it *ex gratia*; and that the proprietors not having sought to get an arrangement on the subject while the negotiations for amalgamation were proceeding, the Committee could now only deal with the appellants as they would with any ordinary ratepayer of the city of Glasgow. The Committee were of opinion that the proposed assessments were legally imposed; and further that no objection could be taken to the form in which they had been imposed. As, however, it was asserted that some of the thoroughfares had been virtually taken over by the Police Commissioners before the amalgamation, the Committee adjourned till May 10 so as to enable the proprietors in such thoroughfares to make good their assertion. After that, those who are not able to establish that their thoroughfares have been taken over, may appeal to the Sheriff against their decision.

What is, in reality, *the* fight over railway rates took place at Westminster this week when a Joint Committee of the Lords and Commons sat to consider the objections by traders and others to the proposed rates for the carriage of goods which have been scheduled by the railway companies. The movement began several years ago, upon objections by traders with reference to differential rates which existed. Now, when the railway companies have made an attempt to equalize their rates, many of the traders are still not satisfied. As metropolitan traders, the Edinburgh and Leith Gas Commissioners were interested in respect of the rates to be charged for the carriage of coal to their works. A deputation of their number, with Mr. Mitchell and Mr. Linton, have been in London; and they were able to come to terms with the railway companies, without the intervention of the Parliamentary Committee. I understand that the proposal of the railway companies was to raise the maximum rate—2½d. per ton has been mentioned; but I have not very complete information on the subject, and must speak with reserve. At all events, what looks like a counter-move on the part of the Gas Commissioners was attempted in a clause which they proposed to have inserted in the Provisional Orders of the railway companies, to the effect, practically, that the charges for carriage were to include terminal and junction services. A compromise having been come to, however, the clause was withdrawn. I cannot yet say whether the railway companies are to amend their schedules in terms of the compromise, or whether the traffic will be conducted by agreement outwith the Provisional Orders. I rather incline to the view that the latter would be an illegal procedure, and that the schedules will have to be amended; but that stage has not been reached yet.

The Dufftown Gas Company, which is being smothered to make way for an electric light installation, have resolved to wind up their affairs as at May 15 next. At the meeting, at which the resolution to wind up was adopted, the shareholders were informed that the electric lighting installation would not be ready this season; but they were assured that it was coming. One is tempted to ask what they will do with it when they get it?

Moffat, as is well known, is one of the most popular health resorts in Scotland. From whatever cause I cannot say, but it is a place where fortunes are not made; and the people who permanently reside there are mostly poor. This circumstance probably explains the fact that it has not been threatened by an exploiting electric light company. The Police Commissioners themselves, however, took the matter up; and on Monday night they had before them a report by Professor Jamieson, of the Glasgow and West of Scotland Technical College, upon a scheme for the lighting of the streets by electricity. The proposal was the now familiar one of taking power from a local stream—in this case the Euan, two miles distant. Even with this cheap source of power, the Professor's report showed that the cost of electric lighting would be double or treble that of gas lighting. The Commissioners accordingly, and very sensibly, resolved to postpone further consideration of the proposal till after the November elections.

Just as I expected, the Corporation electric lighting scheme of Bradford is being trotted out for the purpose of carrying wavering Corporations over the point of decision when they come to decide whether or not they shall go on with an electric lighting scheme. The Sub-Committee of the Aberdeen Corporation on Electric Lighting have been caught by it. At their last meeting, they had before them information, which it has taken them several months to collect, as to the working of installations in various towns. Bradford was the particular instance

which impressed them. "It was shown," it is reported, "that while (in Bradford) 2½ years ago the first half-year's report after the introduction of the light had shown a deficit of £1000, matters had steadily improved; and now, when the fifth half-yearly report has been issued, there is a balance to the good of over £900." The Sub-Committee resolved to proceed with the Aberdeen installation; but "in the meantime," they resolved to ask Professor Kennedy to give them the benefit of his professional advice. Possibly some of your readers, who are better acquainted with this department of work than I am, might be able to tell the Aberdeen Committee what the advice is which they are likely to get. Professor Kennedy's notions are, I presume, quite well known by this time, just as Mr. Preece's or Professor Forbes's are. I wonder why the Aberdeen Committee cannot do a little thinking for themselves. For one thing, it is quite evident that they omit to take note, with reference to Bradford, that the contracts there were for three years; that the time for some of them has therefore nearly expired; and that the seventh half-yearly report—that is the first report after the contracts with the Corporation's first customers for electric lighting have expired—may be very different from the fifth. If the Chairman of the last meeting of the Edinburgh Merchants' Association, as mentioned in my "Notes" of April 12, spoke the sentiments of only a few of the users of electric lighting in Bradford, the prospect of the Corporation in obtaining the renewal of contracts is very slight.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The month closes without any quotable change in prices; and so far as the better qualities suitable for house-fire purposes are concerned, these are still moving off pretty freely at late rates. Best Wigan Arley remains firm at 12s. 6d.; Pemberton four-feet and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals 9s. to 9s. 6d. per ton, at the pit mouth. Other descriptions of fuel are becoming more plentiful in the market; and for these prices are showing a weakening tendency, although list rates remain unchanged. Common round coals are in but indifferent request for iron making, steam, and general manufacturing purposes; and the depressed outlook in the principal coal-using industry, affords but a discouraging prospect for the immediate future. For inland sales, steam and forge coals are quoted at about 8s. to 8s. 6d. per ton at the pit mouth; but for shipment, the demand for which although slightly better than last week is still extremely slow, 9s. 6d. per ton represents about the full average figure obtainable for ordinary descriptions of steam coal, delivered at the ports on the Mersey. The dispute in the cotton trade and the lock-out at a large number of mills throughout Lancashire, is necessarily seriously affecting requirements for engine fuel, and a good deal of slack is just now being thrown upon the market. The principal colliery firms are, however, for the most part preferring to get, or put down into stock, rather than force surplus supplies upon the market at low figures during the temporary stoppage of the mills; but there are low sellers, and special clearance sales are made in some instances considerably under the current quoted rates. At the pit mouth, the best qualities of burgy still average about 6s. 6d., and the best qualities of slack, 5s. to 5s. 9d. per ton, with common sorts not averaging more than 3s. 9d. to 4s. per ton.

Northern Coal Trade.—The coal trade has been erratic and excited of late, partly through expectations of some of the collieries resuming work, and partly through the demand increasing for export. Best Northumbrian steam coal is higher in price, as the season for shipment approaches for the Baltic; and about 12s. to 12s. 6d. per ton, must now be looked upon as the current rate. Even unscreened coal has been sold as high as 11s. 6d. per ton, or at equivalent prices for home use. Second-class steam coal is about 9d. per ton less than best. Small steam is in demand for manufacturing purposes; and where prompt delivery can be given, much higher prices have been offered. It is said that as high as 7s. 6d. per ton has been paid for this class of coal—or double the price of a few weeks ago. There are, however, large quantities of both Yorkshire and Scotch coal being brought into this district; and the gas coal from Scotland has been offered delivered in the Tyne at less prices than that of the Durham quality of gas coal, which is still obtainable from one or two collieries. For local gas coal, as high as 12s. per ton, f.o.b., is still asked. Household coal is more abundant and is dull in price; and similar remarks apply to the bunker coal for steamships. One or two of the Durham collieries not in the Coalowners' Association have been recommenced; and others are expected to follow in a day or two; so that it would appear as if the beginning of the end of the long strike in Durham had come. Coke is still very scarce; and the price of blast-furnace coke is unaltered. Gas coke is quiet, with rather a weak tendency in the price.

Scotch Coal Trade.—Events have taken a turn this week which may have important results, and which at present have the effect of showing that the coal trade is far from being in a healthy condition. It seems that a considerable number of miners who have released themselves from duty in the Durham district have found their way to Scotland in search of work. There is thus a plethora of pitmen; and orders not being very abundant, the coalmasters in Lanarkshire have given notice of a reduction of wages by 6d. per day—about 10 per cent.—and the men show no signs of resistance. In Fifeshire, where a reduction of 7½ per cent. was recently agreed to by the miners, another similar reduction is threatened, and must also be accepted by the men unless a demand for coal springs up. Appearances are against this happening; in fact, it is stated that the demand is so slack that stocks are accumulating, main and splint coal being specially plentiful. The prices quoted last week had consequently receded a little. Main, 7s. 6d. to 7s. 9d.; ell, 8s. 6d.; splint, 8s. 3d. to 8s. 6d.; and steam, 10s. to 10s. 3d. Shipments during the previous week amounted to 147,581 tons, an increase of 6000 tons over the shipments of the preceding six days. For the year, the shipments have been 1,952,564 tons; an increase of 269,747 tons over the corresponding period of last year.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 30.

Sulphate of Ammonia.—In spite of a poor demand, there is little, if any, variation in prices; and the market generally may be considered steady. The quotations at Hull and Leith remain at £10 3s. 9d.; although buyers are trying to get in at £10 2s. 6d. The Liverpool price is £10 1s. 3d. Stocks keep moving off fairly; and it is therefore improbable that the decline predicted in some quarters will take place. There is a fair inquiry forward, but at low prices. Nitrate is rather weak at 8s. 9d. to 8s. 10½d.

LONDON, *April* 30.

Tar Products.—The position of these generally is easier than last week. Benzols have had a further drop; and 1s. 6d. for 90's and 1s. 3d. for 50's is about the current value, although but little business is reported. Creosote and oils are lifeless; and anthracene is considerably weaker—some "B" quality having been sold as low as 7d. Pitch keeps fairly steady for prompt delivery, at from 27s. to 28s.; but forward business is spoken of at several shillings per ton lower. Prices are: Tar, 10s. to 12s. Pitch, 27s. to 28s. Benzol, 90's, 1s. 6d.; 50's, 1s. 3d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 9d. Creosote, ¼d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent. "A" quality, 10½d.; "B" quality, 7d.

Sulphate of Ammonia.—There is no change in this market; and prices are much about the same as those mentioned last week—viz., £10 to £10 3s. 9d., less 3½ per cent. Gas liquor (10-oz.), 5s. to 6s. 6d.

The Profits of the Wigan Corporation Gas Department.—At a meeting of the Wigan Corporation Gas Committee last Thursday the Borough Treasurer stated that the profits of the gas undertaking for the past year, after providing for interest, sinking fund, and all other expenses, amounted to £9140, which together with £3105 brought forward from the previous year, leaves the sum of £12,245 in the hands of the Committee. It was decided that £12,000 should be handed over in aid of the general district fund.

Sales of Shares.—At a recent sale of original consolidated 10 per cent. stock in the *Cambridge Water Company*, lots of £50 realized from £134 to £136 each; and similar lots of consolidated 10 per cent. stock, £126 each—a lot of £10 fetching £28.——At West Hartlepool recently, £5000 of stock in the *Hartlepool Gas Company* was sold at premiums ranging from 50 to 60 per cent.——Last Thursday, at Rochester, four £50 shares (paying a dividend of 10 per cent.) in the *Rochester, &c., Gas Company*, were sold at £112 each, and four at £112 10s. each; two £12 shares in the same Company (paying a dividend of 7½ per cent.) fetching £19 5s. each, and four, £19 10s. each.

Cooking by Electricity.—Last Friday evening, a number of gentlemen assembled in the Royal Hotel, South Shields, on the invitation of Mr. Farquhar M. Laing, to witness experiments in cooking by electricity. Among those present were the Mayor (Mr. J. M. Rennoldson), Mr. W. J. Warner, the Engineer, and Mr. J. H. Penney, the Secretary of the South Shields Gas Company. The experiments were conducted by Mr. J. Patterson and Mr. Horace Angus, of the Newcastle and District Electric Lighting Company. The utensils used were two pans, each about the size of a saucer, with flat tops and small rims. The American machines have already been introduced in Newcastle, and Mr. Laing, being desirous of showing his friends in South Shields this new means of cooking, arranged for the demonstration, which was completely successful.

The Electric Lighting Scheme for Portsmouth.—The Portsmouth Town Council having applied to the Local Government Board for power to borrow £60,000 for electric lighting purposes, Mr. Arnold Taylor, one of the Board's Inspectors, held an inquiry into the matter a few days ago. The Town Clerk (Mr. A. Hellard) stated at the outset that the original application was made on a scheme prepared by Mr. Shoolbred; but this part of the resolution was afterwards revoked, and a scheme by Professor Garnett adopted. The latter gentleman explained his proposals at some length; and he concluded by saying that the cost of the scheme would, he estimated, be £55,300. Mr. B. C. Miller, a councillor, questioned Professor Garnett's capabilities, and suggested that, as he had been called in to report upon Mr. Shoolbred's scheme, someone should be requested to give an opinion upon the Professor's. The present scheme was, he said, only carried by the casting vote of the Mayor. Although Portsmouth was a large borough, with a considerable population, the traders were small people; and he was quite satisfied that the cost of introducing the electric light into their establishments would deter them for many years from superseding their gas supplies, which were obtained at the low price of 2s. 4d. per 1000 cubic feet. He urged that the Corporation were not in a position to undertake any new expenditure of this kind. The Mayor explained that his casting vote was not given as between high and low tension, but in favour of the matter being dealt with at once rather than postponed. Mr. E. J. Pearce put several questions, and said that, while he was in favour of the electric light if it would not entail any extra burden on the ratepayers, he was of opinion that, unless this could be promised, the whole scheme ought to be knocked on the head. Professor Garnett, in reply, said the scheme was only brought forward in the full belief that it would provide for the repayment of capital, with interest, as well as the working expenses, and then furnish some profit. If this was doubted, there would be no difficulty, in the course of a few weeks in getting the whole of the necessary capital subscribed for the undertaking. At 6d. a unit, the electric light was making headway more and more every year against gas at 1s. 9½d. per 1000 cubic feet. Mr. M'Askie said the Corporation had been reproached for having allowed the gas and water supplies of the town to become monopolies. If the ratepayers as a body were to declare that they did not want the present scheme, he as a member of the Corporation would say, "Very well, only don't blame us by-and-bye for not having given you the chance of benefiting yourselves." Mr. Kennedy supported the scheme, on the ground that it would be suicidal to leave it to be carried out by a company. After some further discussion, the inquiry closed.

Sale of Debenture Stock in the Bristol Water Company.—Messrs. Daniel, Selfe, and Co., last Thursday, submitted for sale at Bristol £20,000 of 3½ per cent. debenture stock, created under the powers of the Bristol Water Company's Act of 1888. Prior to offering the stock to the public, Mr. Daniel stated that the present market quotation of the shares was 105 to 107; but he had been informed that there was no stock to be had at that price. Of the £160,000 stock already created, and to which the £20,000 now offered would be allied, there was none on the market that day; and there had been only eleven transfers of the stock referred to, which showed how well it was held. The stock was offered in lots of £100, and they produced the following prices: 90 lots, £105 10s.; 2 lots, £105 7s. 6d.; 11 lots, £105 5s.; and 97 lots, £105.

The Gaslight and Coke Company Fined.—At the Lambeth Police Court, on Monday last week, The Gaslight and Coke Company were summoned, at the instance of the London County Council, for having, on the 11th of December last, supplied gas at the testing-station in the Lambeth Road of less illuminating power than it ought to be under the Act of Parliament. There was a second summons against the Company in respect of gas tested at the station on the 15th of January. Mr. C. A. Roberts, from the Solicitor's Department of the London County Council, appeared in support of the summonses; Mr. Horace Avory, barrister, representing the Company. Mr. Roberts stated that the result of the testings showed the illuminating power of the gas on the dates specified in the summonses to be 15·2 candles in each case; being a deficiency of 0·8 candle, which carried a forfeiture of 40s. Upon the results of the testings being communicated to the Company, they appealed against them to the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.); but their appeal was dismissed. Some formal evidence was given in support of the summonses. Mr. Avory said he was prepared to prove that upon the 11th of December the gas was tested by the Company at their station, and the average illuminating power was found to be 16·24 candles; and upon the 15th of January, 16·9 candles. Therefore it was obvious, if the Council's figures were right, that the difference must have arisen from some unavoidable cause or accident. Mr. Hopkins fined the Company 40s. and 23s. costs on each summons.

The Newington Water Company's Provisional Order.—Major Marindin, one of the Board of Trade Inspectors, opened an inquiry at Hull, a short time ago, with reference to the application made by the Newington Water Company for a Provisional Order, extending their power to procure water for the supply of their district. Mr. Scott-Fox appeared on behalf of the Company; and the Town Clerk of Hull (Mr. R. Hill-Dawe) represented the Corporation. Mr. Scott-Fox, in opening the proceedings, stated that, though the sources of the Company's supply were not failing them, there had been a deterioration in the quality of the water. The Directors, therefore, made investigations, and eventually chose Dunswell as the source from which to draw a further supply of water. Here a borehole had been made, and water was found in every way suitable for domestic supply. Evidence was then called; and subsequently a consultation was held between the Town Clerk and Counsel for the Company, in consequence of the former having intimated that he and several of the witnesses would have to leave that night for London in connection with a Railway Bill. As a result of this, the following agreement was come to: "That inasmuch as circumstances prevented an inquiry into the merits of the objection of the Corporation, and with a view to enable the whole matter to be considered by Parliament, it is agreed that, if an Order be made, it shall be without prejudice to the rights of either party, including that of the undertaking to object to the *locus standi* of the Corporation before Parliament, but the Corporation to have such rights of opposing the confirmation of the Provisional Order in Parliament as they would have had as petitioners against a Bill promoted by the Company for a like purpose." The inquiry thereupon terminated.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 790.)

Issue.	Share	When ex-Dividend	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest. ment.
£			p. c.	GAS COMPANIES.				£ s. d
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	15½—16½	..	6 7 3
100,000	10	,,	7½	Do. 7 p. c	10	11—12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12—14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6⅞—7	..	5 5 9
40,000	5	,,	7½	Do. New	4	4¾—5¼	..	5 14 1
380,000	Stck.	26 Feb.	12½	Brentford Consolidated	100	210—215	..	5 14 1
150,000	,,	,,	9½	Do. New	100	160—165	+2	5 12 2
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stck.	11 Mar.	5	Bristol	100	95—100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42—44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14—15	..	5 13 4
328,750	10	,,	—	Buenos Ayres (New) Limited	10	6¾—7¼	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93—96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	25—27	+1	5 18 6
550,000	Stck.	13 Apr.	13	Commercial, Old Stock	100	230—235	..	5 10 8
165,000	,,	,,	10	Do. New do.	100	185—190	..	5 5 3
130,000	,,	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118—123	..	3 13 2
800,000	Stck.	30 Dec.	13	Continental Union, Limited	100	221—226	..	5 15 1
200,000	,,	,,	10	Do. 7 p. c. Pref	100	192—195	+2½	5 2 7
75,000	Stck.	30 Mar.	10	Crystal Palace District	100	185—195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19—20	..	5 0 0
354,060	10	,,	10	Do. Partly paid	7½	13½—14½	..	5 3 11
5,470,820	Stck.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	202—207	−8	5 15 11
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	94—97	..	4 2 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	245—250	..	4 0 0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 9
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	169—174	..	4 6 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	153—156	..	4 9 9
463,000	,,	,,	10	Do. I, 10 p. c. Prf.	100	241—249	+1	4 0 4
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	145—150	..	4 0 0
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113—116	..	3 9 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	118—123	..	3 13 2
908,000	,,	,,	6	Do. 6 p. c. do	100	163—168	..	3 11 5
3,800,000	Stck.	12 Nov.	12	Imperial Continental	100	224—228	..	5 5 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	106—108	..	4 12 7
541,920	20	27 Nov.	6⅔	Monte Video, Limited	20	14⅜—15⅜	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8—8½	..	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2—3	..	—
420,000	100	3 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	105—108	..	5 11 1
500,000	100	1 Dec.	6	2nd Do.	100	105—108	..	5 11 1
150,000	10	15 Oct.	10	San Paulo, Limited	10	8½—9½	+½	—
500,000	Stck.	26 Feb.	15½	South Metropolitan, A Stock	100	270—275	+3	5 12 9
1,350,000	,,	,,	12	Do. B do.	100	220—225	..	5 6 8
200,000	,,	,,	13	Do. C do.	100	235—240	..	5 8 4
725,000	,,	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	140—145	..	3 9 0
60,000	Stck.	11 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
729,331	Stck.	30 Dec.	10	Chelsea, Ordinary	100	250—255	+2	3 18 5
1,720,252	Stck.	13 Apr.	8	East London, Ordinary	100	193—198	..	4 0 10
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136—140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	96—99	..	4 0 10
708,000	Stck.	12 Feb.	10½	Kent	100	250—255	..	4 2 4
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	218—223	+1	4 5 2
406,200	100	,,	7½	Do. 7½ p. c. max.	100	184—189	+1	3 19 5
260,000	Stck.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120—123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares	100	320—330	..	3 13 6
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk	100	126—129	..	3 2 0
902,300	Stck.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	145—150	..	4 6 8
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	130—135	..	4 16 3
1,155,066	Stck.	11 Dec.	10	West Middlesex	100	240—245	..	4 1 7

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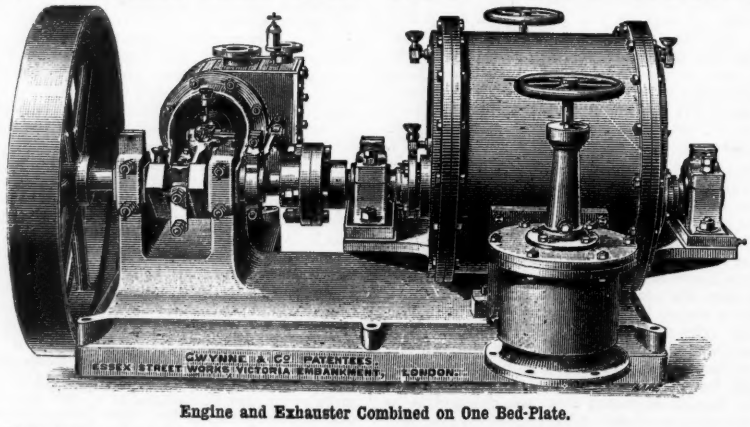
Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



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The Candidate must have served in a similar capacity, having had the control of a large number of Men.
Age not to be below 30, and not to exceed 40 years.
Applications, in writing only, with recent testimonials, to be addressed to the undersigned.
Wages offered Two guineas per week.
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April 21, 1892.

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THE Dewsbury Corporation have for DISPOSAL a LIVESEY WASHER of the capacity of 1,000,000 cubic feet per day.
The Washer is about to be replaced by Apparatus of larger capacity, and can now be seen in actual use at the Savile Town Gas-Works, Dewsbury, on application to Mr. Charles A. Craven, Engineer, from whom further particulars can be obtained.
E. MAWDESLEY, Town Clerk.
Town Hall, Dewsbury, April 6, 1892.

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Gas-Works, Leigh, Lancs., April 1, 1892.

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FOR SALE—The Directors have for disposal a Cast-Iron ANNULAR CONDENSER suitable for a make up to 750,000 feet per day, which has been taken down to make room for extensions. The Condenser is complete with 12-inch Connections and Valves, and will be put on Rail for the sum of £150.
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WASHERS, from 500,000 to 250,000 feet per diem.
CONDENSERS, from 500,000 to 10,000 feet per diem.
EXHAUSTERS, from 120,000 to 5000 feet per hour.
STATION METERS, from 100,000 to 1500 ft. per hour.
Would erect any of the above, and make practically equal to new.
Inquiries invited for any second-hand Gas Plant.
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BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of about 9000 tons of COAL (Screened Nuts or Cobbles), and 1000 tons of CANNEL.
Specification and Form of Tender may be obtained on application to Mr. W. Whatmough, Gas Manager.
Sealed tenders, marked "Coal," to be sent to me not later than Six p.m., on Tuesday, the 17th of May, 1892.
By order,
ALFRED WALLIS, Town Clerk.
Municipal Buildings, Heywood, April 29, 1892.

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WIRKSWORTH GASLIGHT AND COKE COMPANY, LIMITED.

THE Directors of the above Company are open to receive TENDERS for TAR and LIQUOR made during the year beginning on April 27, 1892, and ending April 26, 1893.
Sealed Tenders, endorsed "Tar" or "Liquor," to be sent in, addressed to T. Newton, Esq., Chairman, on or before the 11th day of May, 1892.
JAMES LEE, Secretary.
April 26, 1892.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee are pre- pared to receive TENDERS for the supply of about 26,000 tons of CANNEL and COAL required by them during the year ending the 30th of June, 1893.
Specifications and Forms of Tender can be obtained on application to Mr. Herbert Andrew, Gas and Water Offices, Oldham, to whom tenders are to be sent on or before Tuesday, the 17th of May, 1892.
A. NICHOLSON, Town Clerk.
Oldham, April 25, 1892.

LIVERPOOL UNITED GASLIGHT COMPANY.

THE Directors of the Liverpool United Gaslight Company are prepared to receive TENDERS for the supply of 100,000 tons of CANNEL and 190,000 tons of COAL, to be delivered at the various Works of the Company during the period of Twelve months between the 1st of July, 1892, and the 30th of June, 1893.
Tenders will be received for the whole or any portion of the above quantity.
The Directors reserve the right to accept tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.
Full Particulars and printed Forms of Tender can be obtained, on application to the undersigned, at the Gas Office, Duke Street, Liverpool, to whom tenders (on the printed form) must be sent on or before Tuesday, the 17th inst., endorsed "Tender for Coal."
By order,
WILLIAM KING, Engineer.
Gas Office, Duke Street, Liverpool, May 2, 1892.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

CHIPPING NORTON GAS COMPANY, LIMITED.

TENDERS are invited for the supply and delivery, at Chipping Norton Station, of 420 yards of 4-inch, and 1080 yards of 3-inch CAST-IRON PIPES (Turned and Bored Joints), together with all necessary Tees, Bends, Syphons, and other Irregular Castings. Approximate weight per Pipe of each kind to be quoted, as well as price per ton of each kind.

Tenders for same to be sent, on or before May 14, to

T. BURTONSHAW,
Manager.

TENDERS FOR COAL.

THE Scarborough Gas Company invite TENDERS for the supply of about 18,000 tons of best screened GAS COAL or COBBLES per annum for One or Two years from the 1st day of July next.

Tenders, endorsed "Tender for Coal," must be delivered at the Company's Offices, not later than Ten o'clock a.m. on Monday, the 9th of May next.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM J. MOON,
Secretary and Manager.

Scarborough, April 23, 1892.

ACCRINGTON GAS AND WATER WORKS COMPANY.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Directors invite Tenders for the purchase of the TAR and AMMONIACAL LIQUOR which may be produced at their Accrington and Great Harwood Works during a period of One year, commencing on the 1st of July next.

The quantity will be about 1800 tons of Tar and 8000 tons of Liquor (10-oz.).

Tenders, addressed to the Chairman, Offices of the Company, St. James's Street, Accrington, must be in my hands not later than Wednesday, the 8th of June.

By order,
CHAS. HARRISON,
Secretary and Manager.

CITY OF BIRMINGHAM.

TENDERS FOR AMMONIACAL LIQUOR.

THE Gas Committee invite Tenders for the purchase of the AMMONIACAL LIQUOR produced at their Works during a period of Ten years, beginning on July 1, 1893.

The quantity produced in the year ended March 31, 1891, was 13,682,000 gallons of 10-oz. Liquor.

Provision may be made for dealing with the Liquor either in Works now erected on Land belonging to the Corporation, or on Land to be let for the erection of new Works.

Copies of the conditions on which tenders are invited may be obtained on application to

EDWIN SMITH,
Secretary.

City Gas Offices, Council House,
Birmingham.

WALLASEY GAS AND WATER WORKS.

TO COAL MERCHANTS AND OTHERS.

THE Wallasey Local Board are prepared to receive TENDERS for the supply of about 15,000 tons of CANNEL and GAS COAL for their Gas-Works, and about 500 tons of STEAM COAL (Burgy and Slack), for their Water-Works, delivered in Wagons at Duke Street, Birkenhead, separately, for One, Two, or Three years, from the 30th of June next.

Specifications and any further information may be obtained on application to the Engineer at the said Works.

Sealed tenders, addressed to the "Chairman of the Gas and Water Committee," and endorsed "Tender for Coals," to be left at my Office, as below, not later than Five o'clock in the Afternoon of Thursday, the 12th day of May, 1892.

The Contractor will be required to enter into a bond with approved sureties for the due performance of the contract, which contract and bond will be prepared at the expense of the Contractor.

The Board do not bind themselves to accept the lowest or any tender.

By order,
W. DANGER,
Clerk to the Board.

Public Offices, Egremont, Cheshire,
April 29, 1892.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 45,000 tons of best well-screened large GAS COAL, to be delivered between July, 1892, and June 20, 1893, in monthly quantities, in accordance with the Specification.

Parties tendering may do so for the whole quantity or for quantities from 5000 tons upwards.

Forms of Tender and Specification of monthly deliveries may be obtained on application to Mr. H. Morley, the Company's Engineer.

Sealed tenders to be sent to the undersigned not later than Thursday, the 2nd day of June next, addressed to the Chairman of the Company, and endorsed 'Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order
GEORGE CLARRY,
Secretary.

Gas Offices, Cardiff,
April 30, 1892.

OLPHERT'S OXIDE.

FINEST Quality of Natural Bog Ore. Apply for particulars to the Sole Agent, Mr. THOS. L. ARCHER, Cathedral Chambers, Half Street, MANCHESTER.

TENDERS FOR GAS COAL.

THE Directors of the Romford Gas and Coke Company, Limited, invite TENDERS for the supply of 3000 tons of best SOUTH YORKSHIRE SILKSTONE, or other high-class inland COAL, during the Twelve months ending June 30, 1893.

Tenders, endorsed "Tender for Coal," and stating price per ton delivered free at Romford Station, G.E.R. (as per schedule, to be supplied by the Company), to be sent in on or before May 14, addressed to the Chairman of the Company.

Payments will be made only on the quantity delivered over the Gas Company's Weighbridge.

The Directors do not bind themselves to accept the lowest or any tender.

HY. JOHNSON,
Secretary.

Romford, April 30, 1892.

TO BUILDERS AND CONTRACTORS, ETC.

THE Gas and Water Committee of the Ashton-in-Makerfield (Lancs.) Local Board invite TENDERS as follows:—

(a.) For Excavating for and building a GAS-HOLDER TANK, 72 feet diameter, and 24 feet deep.

(b.) For a TELESCOPIC GASHOLDER in two Lifts, the lower Lift 70 feet diameter and 24 feet deep. The upper Lift 68 feet diameter, and 24 feet deep, with Wrought-Iron Lattice Columns and Girders, Guide Rails, Inlet and Outlet Pipes, and Valves complete.

Drawing and Specification of the Tank may be seen on application to the undersigned.

Drawings and Specification to accompany tender for Gasholder.

Particulars may be obtained on application to the undersigned.

Tenders, endorsed "Gasholder Tank" or "Gasholder," to be delivered to me on or before Monday, the 9th of May next ensuing.

The Committee do not bind themselves to accept the lowest or any tender.

JAS. HILL,
Clerk, &c.

April, 1892.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TO IRONFOUNDERS, ETC.

THE Gas Committee are prepared to receive TENDERS for the supply of about—

400 yards 20-inch diameter CAST-IRON MAINS. Weight per yard not to exceed 500 lbs.
300 yards 18-inch do. Weight per yard not to exceed 400 lbs.
250 yards 16-inch do. Weight per yard not to exceed 350 lbs.
800 yards 10-inch do. Weight per yard not to exceed 170 lbs.
Also, two 14-inch diameter and one 8 inch diameter SLIDE-VALVES.

Tenders, endorsed "Mains," and addressed to the Chairman of the Gas Committee, to be sent in on or before the 12th of May next.

The resolution of the Council that Contractors will be expected to pay the average rate of Wages paid in the district will apply to this Contract.

Forms of Tender, and all further Information, may be obtained on application to the Engineer, Mr. S. Meunier, Stockport.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
WALTER HYDE,
Town Clerk.

April 29, 1892.

GLASGOW CORPORATION GAS.

RESIDUAL PRODUCTS FOR SALE, AND RESIDUAL PRODUCT WORKS TO LET.

THE Glasgow Corporation Gas Commissioners are prepared to receive TENDERS for (1) The purchase of the TAR and AMMONIACAL LIQUOR produced at their Temple Farm and Old Kilpatrick Gas-Works for the period from the 1st of June, 1892, to the 31st of May, 1893; (2) the purchase of the TAR and AMMONIACAL LIQUOR produced at their Pollokshaws Gas-Works for the same period; and (3) a LEASE of the RESIDUAL PRODUCT WORKS, in West Street, Glasgow, recently acquired by the Corporation from the Glasgow Alum and Ammonia Company, Limited, for the period from the 15th of May, 1892, to the 11th of November, 1893.

Forms of Tender for the Residual Products on which offers must be made, and Cards of Admission to inspect, and all other particulars with reference to the Residual Product Works, may be had on application to the Manager at the Gas Office, 45, John Street, Glasgow; and offers, endorsed "Tender for Residual Products," or "Tender for Residual Product Works," will be received by the Subscriber on or before Tuesday, the 3rd of May, 1892.

The Commissioners do not bind themselves to accept the highest or any tender.

J. D. MARWICK,
Town Clerk.

City Chambers, George Square,
Glasgow, April 20, 1892.

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GAS-WORKS: Their Construction and Arrangement, and the Manufacture and Distribution of Coal Gas. By S. HUGHES. Eighth Edition. Revised, with Notices of Recent Improvements. By WM. RICHARDS, C.E.

London: CROSBY LOCKWOOD & SON, 7, STATIONERS' HALL COURT, E.C.

MESSRS. Wheatley and Mackenzie beg to say that they have acquired the business of the late W. H. BENNETT, Esq., and that having a special experience in matters connected with Gas, Water, and Sanitary Improvement, will continue to give the same assistance to Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, or LETTERS PATENT.

Patents completed or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

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Information as to cost, &c., supplied gratuitously upon application to WHEATLEY AND MACKENZIE, 40, Chancery Lane, LONDON, W.C.

EXTENSION OF TIME.

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the construction of a THREE-LIFT NON-TRUSSED GASHOLDER, with Wooden Frame for supporting the Crown. Also an ANNULAR WROUGHT-IRON TANK, together with Wrought-Iron Piers and Standards, and Inlet and Outlet Pipes complete. To be erected on the Forge Estate, Dewsbury Road, belonging to the Gas Department of the Corporation.

Diameter of Gasholder, 240 ft.; diameter of Tank, 241 ft. 6 in.; depth of Tank, 40 ft. (22 ft. of excavation, and 18 ft. of embankment).

Each party tendering to furnish his own Designs and Specifications, and to take all responsibility of the necessary excavation and shoring for the Wrought-Iron Tank referred to.

Each tender to state the total weight of Gasholder and Tank separately, which will be checked by all the material being passed over the Corporation or other Weighing Machine.

The whole work to be done to the satisfaction of the Gas Committee, or whom they may appoint.

Endorsed tenders to be sent, addressed to the Chairman of the Gas Committee, Municipal Offices, Leeds, not later than the 18th of May next; and the Committee do not bind themselves to accept the lowest or any tender.

ENFIELD GAS COMPANY.

SALE OF 400 £10 SHARES BY ORDER OF THE DIRECTORS.

MR. ALFRED RICHARDS will sell by Auction at the Mart, E.C., on Monday, the 9th of May, at Two o'clock precisely, in lots, 400 £10 SHARES in the Enfield Gas Company.

The last Dividend on the same class of Shares was at the rate of 7 per cent.

Particulars of J. PURDEY, Esq., Secretary to the Company, ENFIELD; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.; and TOTTENHAM.

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MR. ALFRED RICHARDS undertakes the issuing BY AUCTION of GAS AND WATER SHARES under Parliamentary Powers.

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The next Sale will take place at the Mart, on Friday, May 20, at Twelve for One o'clock precisely, and will consist of Shares in the following Companies:—

Brighton and Hove General Gas Company.
Southend Gas Company.
West Ham Gas Company.
Harrow District Gas Company.
Romford Gas Company.
Woking Water and Gas Company.

Terms for including Shares in these Sales, and all particulars relating thereto, may be had of Mr. ALFRED RICHARDS. Offices: 18, FINSBURY CIRCUS. E.C.

Price 2s. per dozen, or 10s 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

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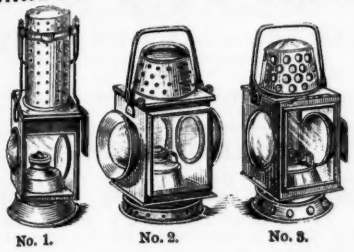

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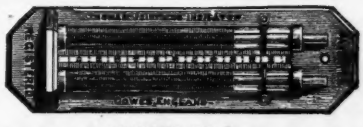

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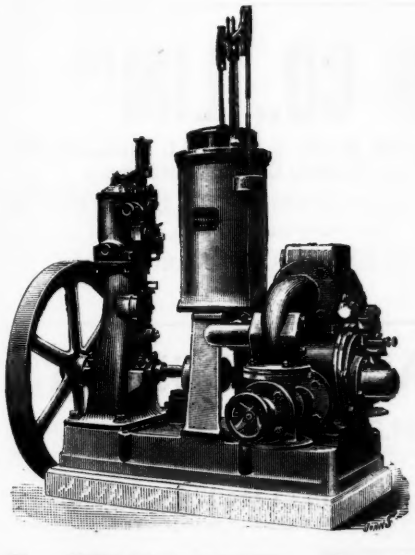

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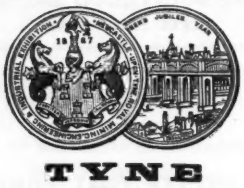

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Yield of Gas per ton	10,500 cub. ft.
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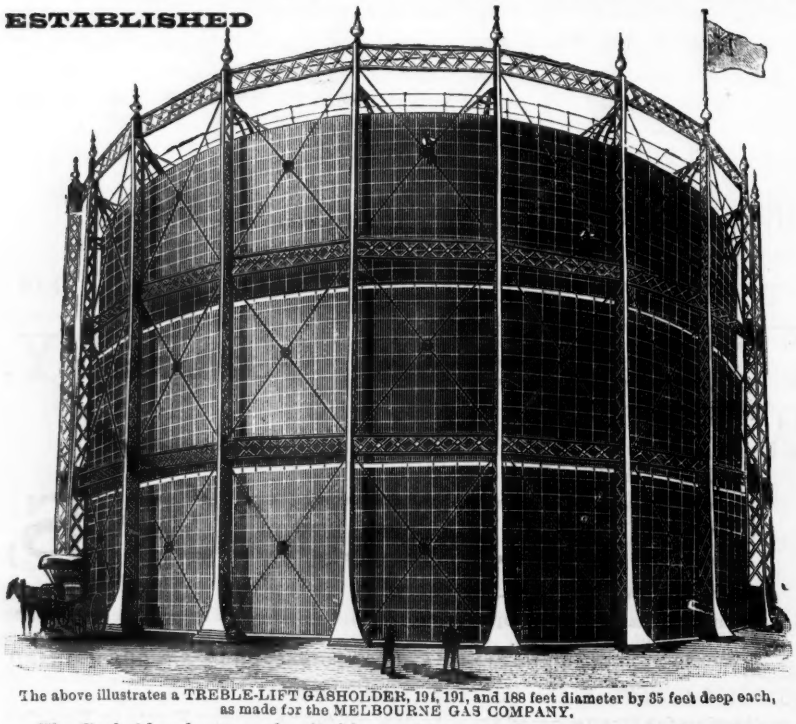

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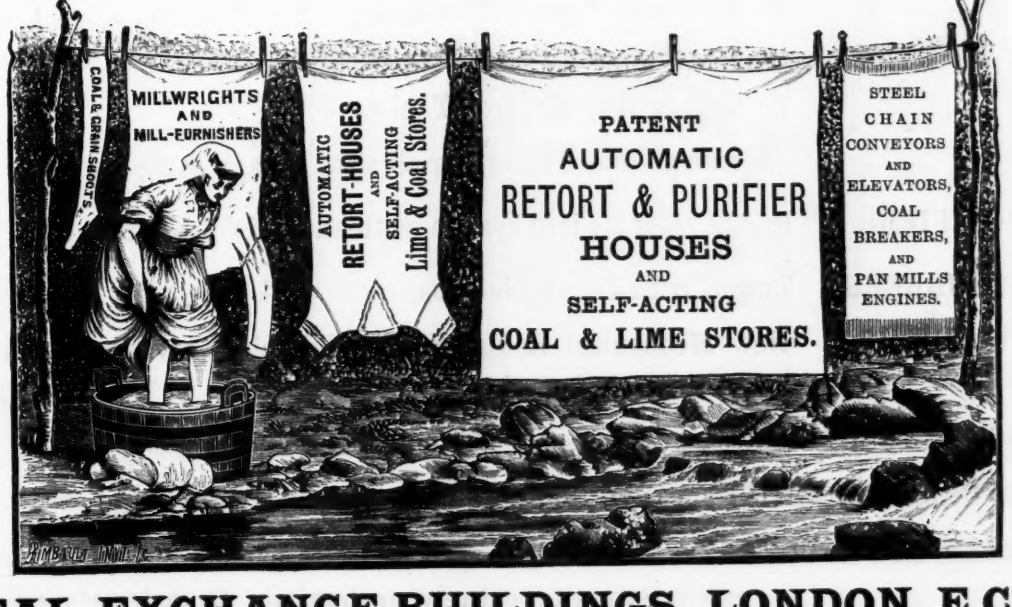
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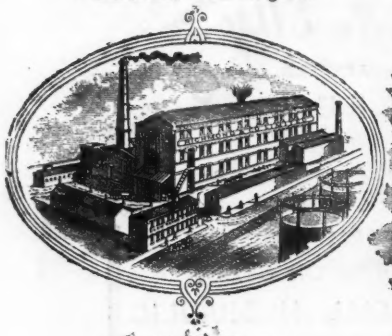

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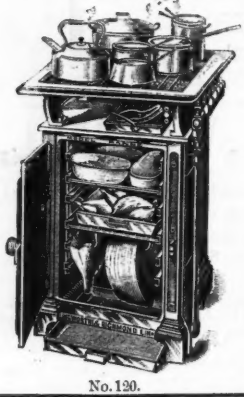

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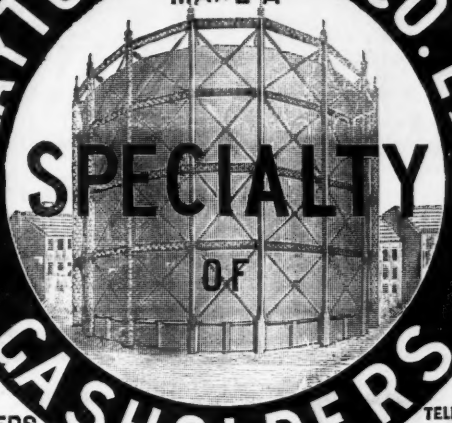

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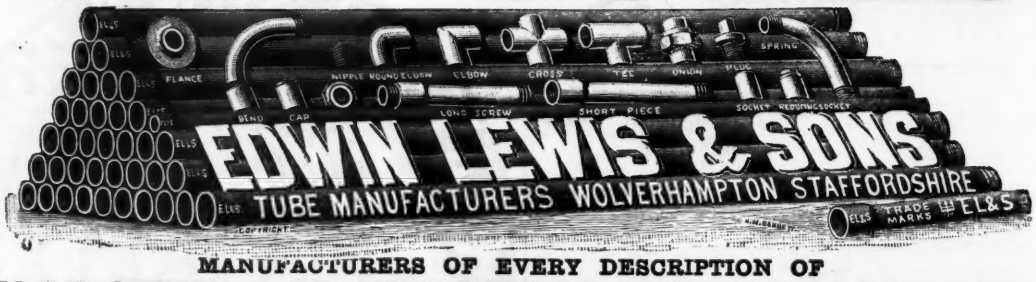

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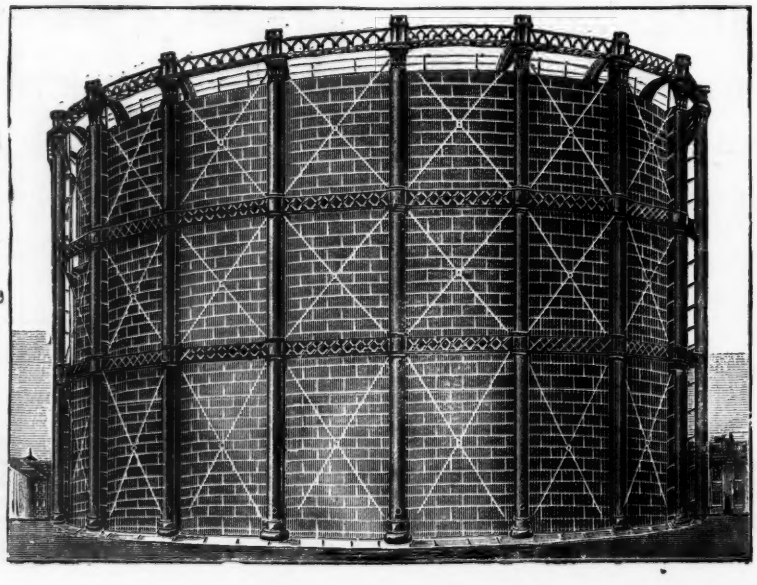

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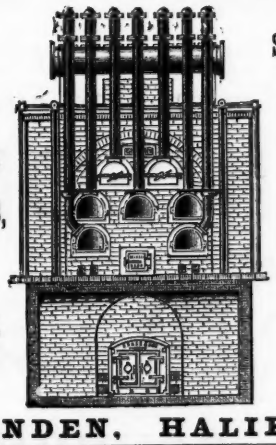

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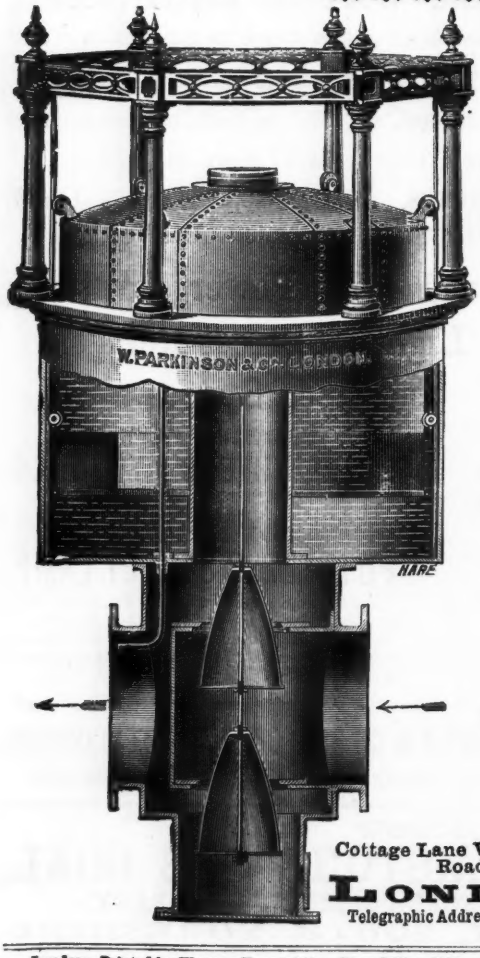

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